the OIL AND GAS JOURNAL
PUBLISHED WEEKLY OCTOBER 16, 1961

NEWS

Pressure is growing on crude prices ▸ 57

Biggest gas deal is laid before FPC ▸ 66

ENI will fight private firms in new area ▸ 80

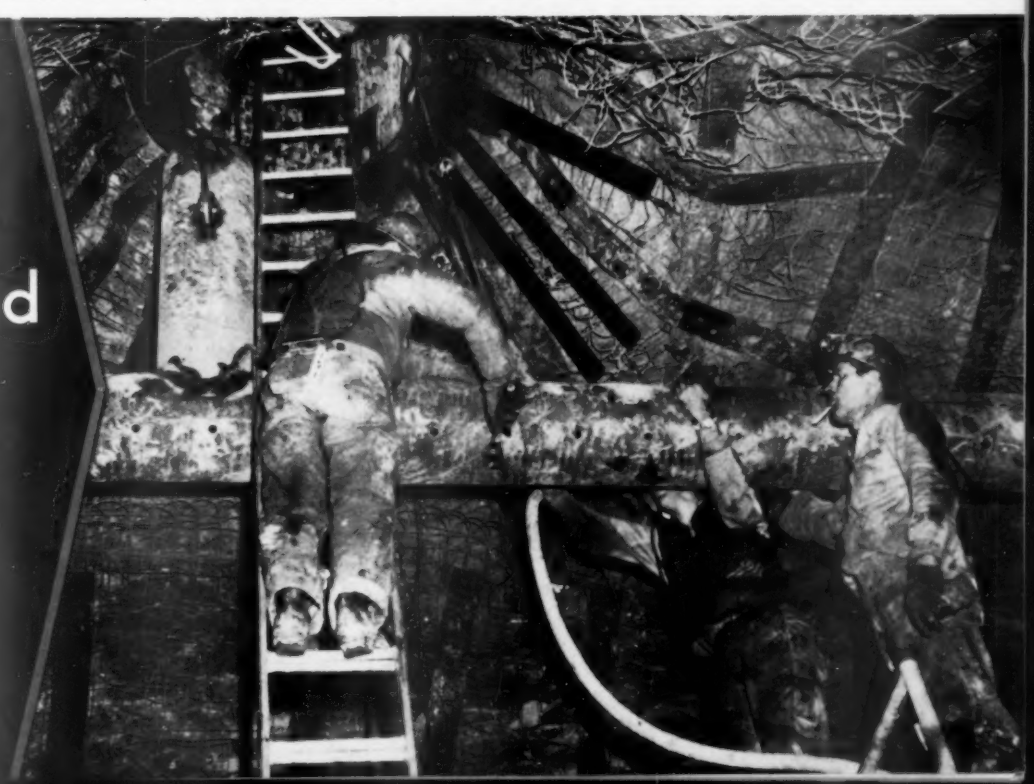
SPECIAL FEATURE

New Dixie pipeline runs "tight" ▸ 96

ANNUAL SURVEY

Underground Storage of LPG

p. 84



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OIL AND GAS JOURNAL
Vol. 59, No. 42

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The Oil and Gas Journal is published weekly by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa 3, Okla. Second-Class postage paid at Tulsa, Okla. Copyright 1961 by The Petroleum Publishing Co. United States and foreign rates to the petroleum industry, 1 year $6, 2 years $9, 3 years $12.

Technology

Special Report:

LPG storage capacity leaps 25% 84

By Robert B. Bizal

New Journal survey shows present capacity at 67,428,960 bbl. and still growing fast. New facilities will expand this to 76,451,580 bbl. Increased production and LPG sales spur further underground storage. Industry has completed 14 new caverns the past 6 months, and another 18 are now under way. Summer inventory hits record high, awaits winter's tug. Canadian storage capacity is at 2,070,000 bbl. Survey gives company-by-company rundown.

Drilling

Hydraulic motors power draw works 91

What is probably the first large-size draw works ever to be powered by hydraulic motors is now drilling in England. On this unusual rig, two 200-hp. fluid motors drive a conventional National T-32-S rig. Chief reasons behind the hydraulic-motor design are these: (1) It fills the need for a completely flameproof drive in the vicinity of the wellhead; and (2) It is packaged so that offshore wells can be worked over from a very small platform.

Refining-Processing

Here's how to fish for a pump 94

This refinery water-well pump was recovered 2 days after the casing parted.

Survey predicts hike in foam use 95

Production is expected to increase from this year's 248,000,000 lb. to 740,000,000 lb. in 1966.

Pipelining

Special Report:

Dixie's new 1,080-mile LPG line 96

By Paul Reed and John O'Donnell

The system will be "tight." Receipts and deliveries must be in balance, and propane will be received by the line at a standard specification. Only limited storage will be available at terminals. Pumping and injection stations are to be remotely controlled and unattended. The line uses variable-speed couplings, packaged switchgear, extra-length joints and record-size, shop-fabricated tanks. Sponge-type scrapers will be used to dry the line. Main-line contractors are preparing common sites for stations and terminals and are installing prefabricated piping.

Crossing agreements should serve mutual ends 130

By B. Z. Kastler, Jr.

Methods are available for pipelines to forestall unreasonable demands by railroads. If conferences between the executives of the companies involved do not work out, laws of most states permit one utility or "public use" to condemn rights from another. And in several states Public Service Commissions have jurisdiction over crossings.

Cities Service adds facilities 132

Three new compressor stations and modernization of several older ones are included in the capital-expenditure budget of Cities Service Gas Co. for 1961.

Production

Ever see a water flood? 115

By C. C. Mattax and J. R. Kyte

A capillary micromodel has been used to study fluid distributions under various wettability conditions, and to find the effects of wettability on water-oil displacement. This article gives the results of these studies, with detailed photographs of the events occurring within the model.

THE OIL AND GAS JOURNAL **Newsletter**

October 16, 1961

Significant this week

Crude prices are under a strain that could unleash a wave of crackups.

Price cuts in Rockies put pressure on Mid-Continent. This raised fears of a chain reaction: Mid-Continent crackup could peril West Texas, Arkansas, and North Louisiana crudes—then Gulf Coast and nearly all other producing areas could weaken.

Note of hope: There's no general inclination to whittle away at prices. Privately, many executives are saying they would prefer to lay off crude prices and concentrate on restoring strength to products markets (p. 57).

Biggest natural-gas deal of all time is now before FPC.

Agency approval is sought on portions of a billion-dollar transaction involving Humble, Columbia Gas System, and the new Monterey Gas Transmission Co. Program covers 30-year period.

Monterey seeks authority to move King Ranch gas in South Texas to Columbia lines at Alexandria, La. Humble owns the in-place reserves that would be tapped by Monterey.

Of particular interest: No escalation in price is provided for at the point of production (p. 66).

Producers must have incentive if U. S. is to continue to have enough natural gas at reasonable consumer prices.

That's the gist of 14 experts' testimony submitted by producer interests at last week's opening of area-price hearing for Permian basin.

Since this case will set precedents, future developments in Washington hearing will be watched carefully (p. 62).

LPG underground-storage capacity is growing fast.

Capacity total in U. S. already exceeds 67 million bbl. Nine million bbl. of new capacity is being added, for total of more than 76 million bbl. That represents a 25% jump over capacity a year ago.

Annual Journal survey of underground storage gives state-by-state rundown on facilities, including those in planning stage (p. 84).

Speaking of storage: Did you know liquid natural gas can be kept in a frozen hole in the ground?

Technique was shown to oil and gas men last week by Conch International Methane and Constock Pritchard. Demonstration pit near Lake Charles, La., had no lining, was capped by insulated aluminum roof. Frigid liquid (-258° F.) is retained

only by surrounding frozen ground in this simple, inexpensive method of storage (p. 60).

If the oil industry doesn't start attracting more engineering talent soon, it will find itself in real trouble.

This problem was in the spotlight at the annual meeting of the AIME's Society of Petroleum Engineers last week.

Various speakers hammered on the need for oil to project a better industry image. Other suggestions included a call for programs aimed at getting bright high-school students interested in a petroleum career (p. 72).

The SPE meeting heard two reports on fire-flood projects. Both reports told of excellent recovery.

Pan American Petroleum said it recovered 74% of the oil in place under a pilot tract in Wyoming's Shannon field.

Sinclair recovered 59% of the oil in its experiment in Allen County, Kansas (p. 75).

Optimism shines through Chase Manhattan Bank's new 10-year forecast on the oil industry. But there's a note of caution.

Shoring up the optimism, bank says oil and gas will supply 73% of free world's energy needs by 1970.

However, Chase Manhattan study finds cause for concern in trend toward more governmental intervention. This course is viewed as biggest danger to oil's ability to grow (p. 78).

New Dixie LPG line across southeastern states will be "tight" system: Deliveries to the line must be held to the rate of withdrawals at terminal points.

Exclusive Journal report on features of line starts on p. 96.

Sand cleaning of a natural-gas pipeline in California has increased throughput by 8½%.

Southern California Gas Co. moved sand in low-pressure gas stream through a 39-mile section of 8-in. line. Erosion check showed no measurable wear from sanding (p. 64).

Hydraulic motors are being used to power big draw works now drilling in England.

It's believed this is the first time large-horsepower hydraulic motors have been used in this fashion (p. 91).

In oil news abroad:

Two recent deals make it plain that ENI boss Enrico Mattei is a formidable competitor in both hemispheres.

He has obtained pipeline right-of-way across Switzerland into southern Germany, a move which puts him into a race with world's big oil companies for a major market.

And a group of Italians led by ENI has won a $240-million

contract to build a gas pipeline system in Argentina.

Oil men face a real challenge in the glib, well-heeled Mattei (p. 80).

Pakistan is gearing up for its venture into oil.

Two governmental companies have been created—one for exploration work, the other for marketing. And a team of Russian technicians has arrived to help in oil hunt (p. 83).

News in the making

More pipelines are showing interest in aviation-type gas turbines for driving centrifugal compressors.

Columbia Gulf proved turbines of this kind can be successful in trunk-line transmission. Additional orders are being received by manufacturer.

Rotary-drilling pattern indicates fourth-quarter well completions this year will top 1960 figure for same period.

Rig average for past 4 weeks is 1,840 compared with 1,779 for corresponding weeks last year.

Wildcatters are still busy in Alaska, although the duster count is rising.

Latest dry hole—third in recent weeks—is Union Oil's Fish Creek Unit 12-8 in Knik Arm area, north of Anchorage.

Union and its partner, Ohio Oil, took the well to 6,413 ft. before plugging it.

Adequate supply of process water is becoming more of a problem for refineries and petrochemical plants.

But recent studies show plants can turn to greater usage of municipal waste water. Properly treated waste water got clean bill of health in these studies.

Effects of residual phosphates and foaming agents are the chief limiting factors in use of waste water.

Expect gas-well completions in California's Sacramento Valley to rise sharply.

Reason: Pacific Gas & Electric is laying 20-in. gathering line into Sutter and Colusa counties, two of valley's brightest exploration areas.

Line will tap wells in Buckeye, Grimes, and Kirk areas where many proved locations have been awaiting outlet.

Look for a change in top echelon of Venezuela's Ministry of Mines and Hydrocarbons.

Dr. Eduardo Acosta, whose post is second only to minister, is slated to step down as technical director and become a private consultant in Caracas.

Acosta may still accompany Minister Juan Pablo Perez Alfonzo to Third Arab Oil Congress in Alexandria—but in a consultant's role.

Market memo

Oct. 16, 1961

Here's one explanation making the rounds of why **Mid-Continent gasoline prices** have practically fallen through the floor:

One refiner outside the Mid-Continent area with access to the Great Lakes Pipe Line has a contract to supply an account out of the line at a price three-fourths of a cent below any published price. The contract unfortunately has no price floor.

The buyer has been able to use each sale to drive down published prices and get a lower price on his next load. At the same time, he was beating the stuffing out of everyone else's price.

Gasoline prices in the Mid-Continent dipped another fourth of a cent last week to 9.5 cents for 91-octane regular, lowest level since 1950. **No. 1** was steady at 9.25 and **No. 2** at 8.50. There was **little spot activity on the Gulf Coast or the river.** Several cargoes of gasoline are available at discounts of from three-eighths to one-half off the posted 10.75 cents for 90-octane and 11 for 92-octane. No. 2 is tight at 8.50 posted price. Depressed gasoline prices prevailed over much of the East at both dealer and retail levels. Markets are down in Virginia, Pennsylvania, New York, and New England.

Credit cards: Don't count out the universal credit-card idea. It's still being talked, and there's some sentiment for a massive exchange of credit-card privileges among companies as the first step toward a universal card . . . Nearly every company has a campaign among employes to get new credit-card customers. Value of these is shown by Phillips' experience where the program produced 800,000 new credit-card accounts and $200 million gross business . . . Shell has a goal this year of adding a million cards through its program.

Prediction: Gasoline prices of independents and majors eventually will be the same, says marketing executive of one major. In many cases both now offer same product, facilities, and services. Independents, however, are taking more of the market. Average good major station will sell 15,000 gal. per month, a comparable independent 35,000 gal. Even if the independent's profit margin is smaller, the return per station is as good or better.

Oil changes: Dipstick tags bearing records of the last oil change and reminders when the next is due are coming back into vogue. They are latest industry effort to push API-recommended motor-oil change intervals and reverse trend to less frequent crank case drains.

Expansions: Humble into Sarasota, Fla., area by buying Singleton Oil's 15 stations in five cities . . . Douglas into Oregon with new outlets at Eugene and Medford . . . Fina into San Antonio, Tex., by adding Tyro Oil as jobber . . . Delhi-Taylor into new 160,000-bbl. products terminal in Syracuse, N. Y., third new facility in company's New York State drive to serve independent jobbers and private-brand station chains.

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LONE STAR OIL WELL CEMENTS

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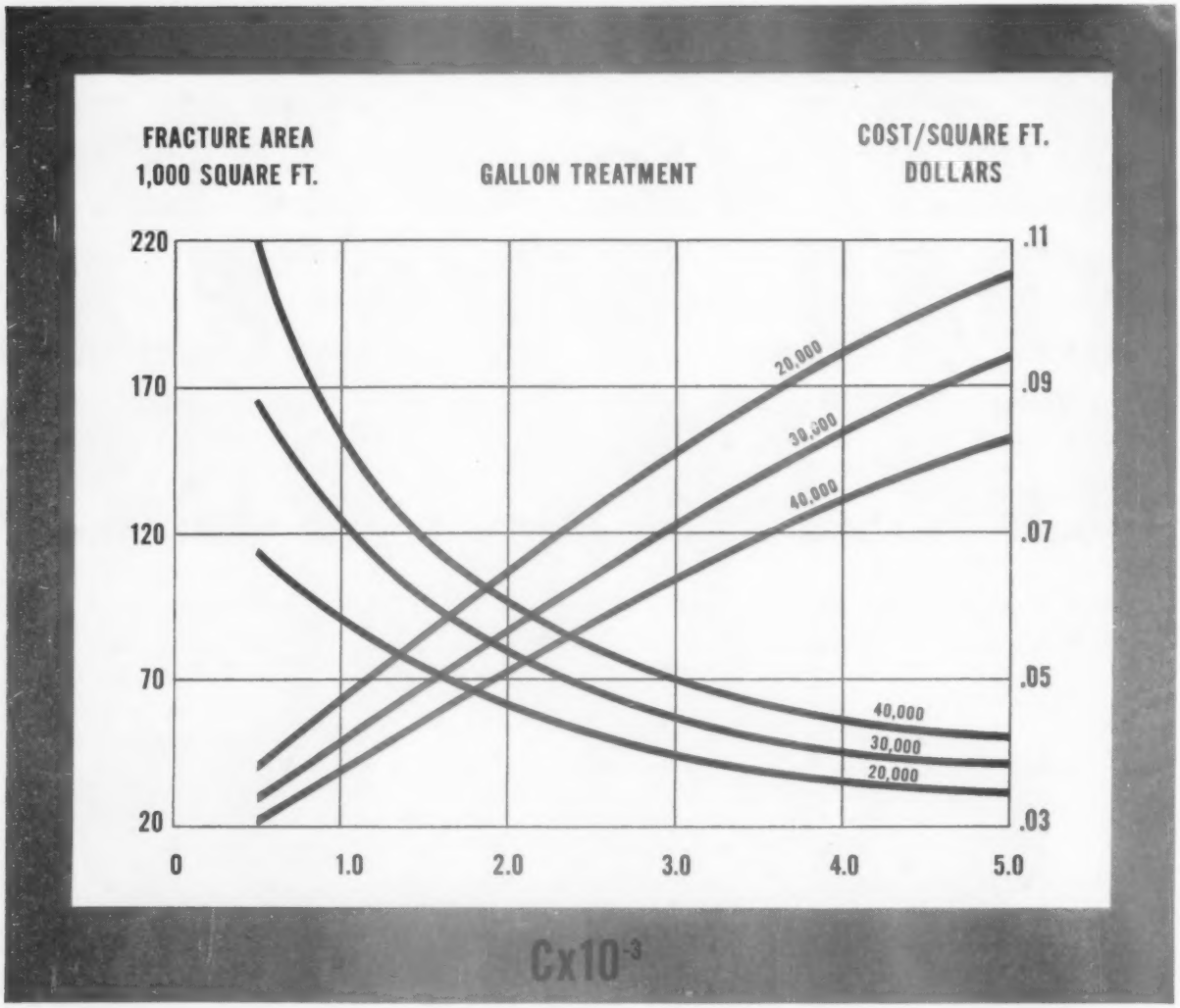

Choose ADOMITE additives for efficient fracturing

Perhaps the most important consideration in any frac job is the fluid-loss coefficient, C, of the fracturing fluid. As a direct measure of fluid loss, it is inversely related to the efficiency of the oil. A low C value means more fracture area with lower costs per square foot. Most refined frac oils will give a C value of 5.0×10^{-3} and higher. Coefficients of 1.0×10^{-3} or lower are commonly obtained with ADOMITE fluid-loss additives.

The importance of a low C factor is readily apparent from a study of the graph. It shows a number of typical situations with a pump rate of 30 BPM.

For example, a 40,000 gallon job with a C factor of 1.0×10^{-3} will result in a fracture area twice the area of a treatment run with a C factor of 3.0×10^{-3}. The higher fracture area means substantial reductions in cost per square foot... the only *true* measure of efficiency!

For additional information or copies of the nomographs used for calculations of fracture design, contact your nearest ADOMITE representative:

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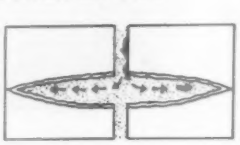
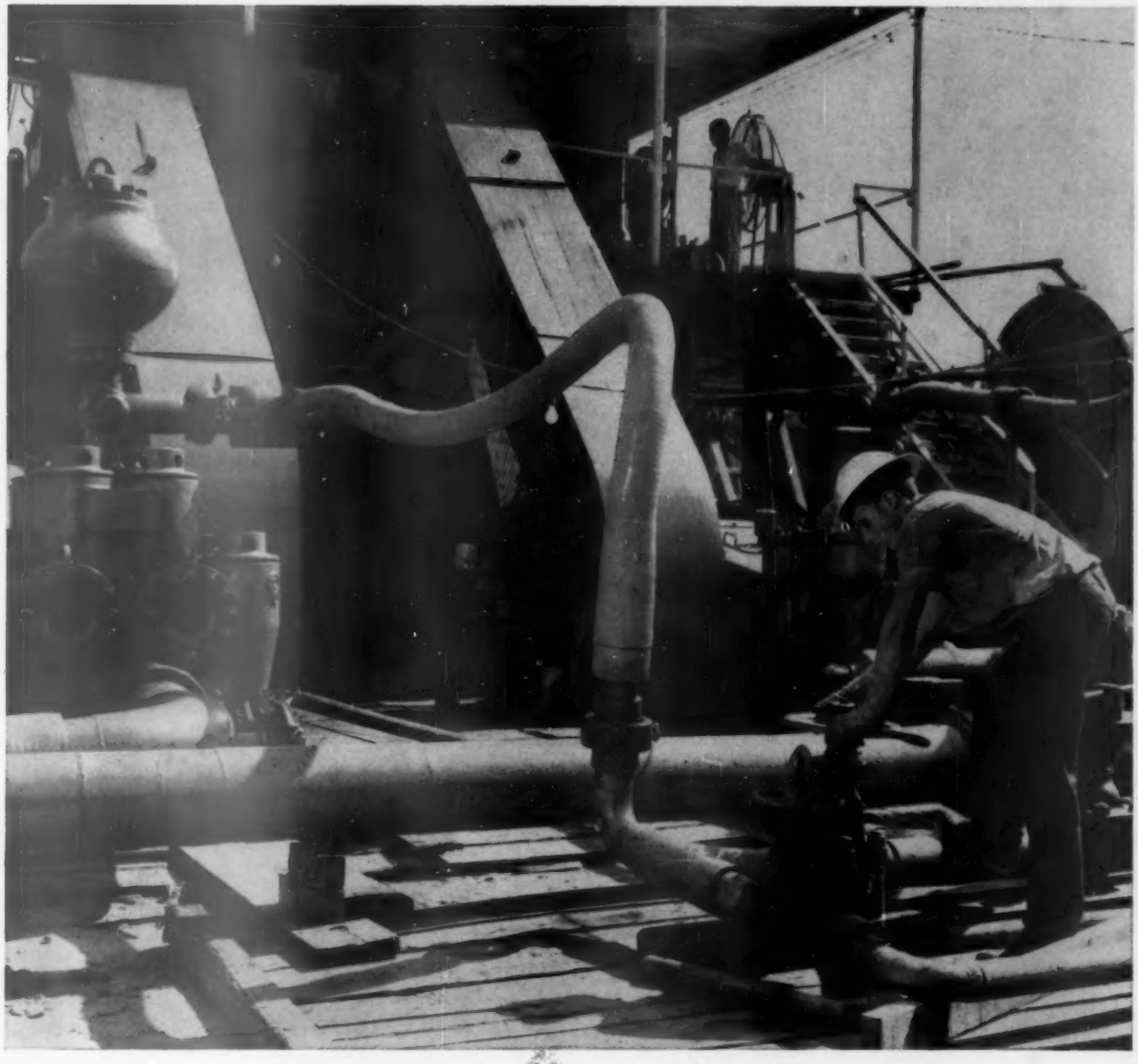


"30,000 frac jobs can't be wrong!"



Pump wants to jitterbug, but hose won't dance

THAT hose was specially developed by B.F.Goodrich to keep the destructive vibrations of the mud pump from shaking off connections. It's so flexible that it absorbs the pump's vibrations, can't be jarred loose. And it's so tough it lasts for years under the most severe operating conditions.

Spiral-wrapped cable wires make B.F.Goodrich vibrator hose resistant to bursts. Hose ends are reinforced to protect against bending stress at the couplings.

It has an abrasion-resisting, oil-resisting tube that will not swell, rot or wear away. Tube is smooth so mud flows through at high speed.

The thick rubber cover on the hose is extra tough—resists gouges, scrapes, tears. Hose can be loaded onto trucks, moved from job to job, dragged into position without fear of damage. Sun, wind and rain won't weaken it either.

When B.F.Goodrich vibrator hose offers all this, why settle for anything less? You'll find it at leading supply houses in the oil field, or at any of these B.F.Goodrich warehouses: Los Angeles, Great Bend, New Orleans, Shreveport, Hobbs, Oklahoma City, Tulsa, Corpus Christi, Dallas, Houston and Odessa. *B.F.Goodrich Industrial Products Co., Dept. M-192, Akron 18, O.*

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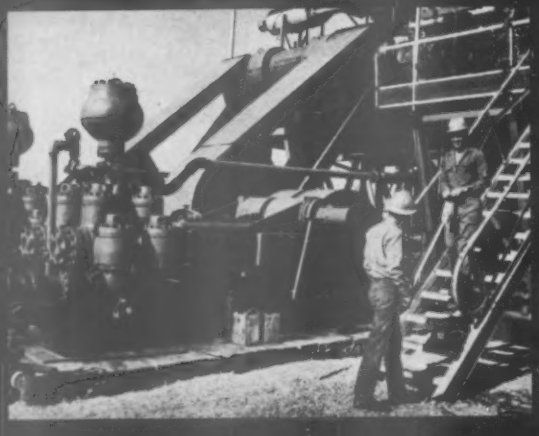
VIBRATOR HOSE

It pays to be curious . . .



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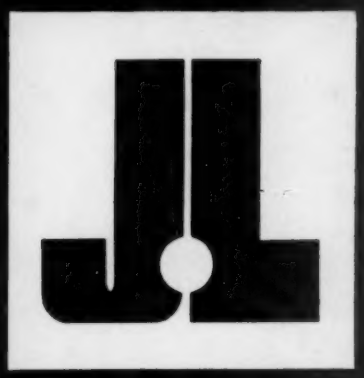

SUPPLY

. . . Bulletins for drillers

Want to know how two men using no tools can lay three miles of leak-proof McDowell "Fast-Line" pipe in one day? Gas, water, oil or air lines can be installed to your rig in short order.

Want to know why Gardner-Denver mud pumps step up drilling efficiency - why J&L drill pipe digs the world's deepest wells - and also saves on not-so-deep drilling?

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makes one gauge do the work of many

Instead of one, two, or more pressure gauges to the tree, now all you need is *one gauge per gauger*. Where you would ordinarily install a gauge and valve, simply install a unibolt Gauge Valve (Fig. 2). A calibrated gauge should be inserted in an upper element, or Connector, (Fig. 1). To obtain a pressure reading, just insert the Connector in the Gauge Valve. Half a turn engages a J-slot and opens the valve, exposing the gauge to well pressure. Remove the gauge and the valve closes automatically. Since a single gauge is used for any number of wells, that gauge may be checked and calibrated frequently to insure accurate pressure readings for all wells. No gauge inventory. No breakage. No replacements. No repairs. Safe and easy to use. Stainless steel throughout.

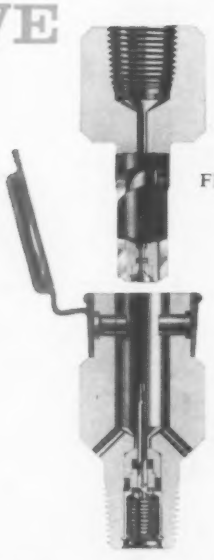

FIG. 1

FIG. 2

Connector, or upper element (Fig. 1), is attached to gauge and carried from well to well.
Gauge Valve, or lower element (Fig. 2), is installed on the tree permanently.

UNIBOLT

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BETTER MUD CLEANOUT

Can Help Increase Profit From Your Wells

Cleaning the well ahead of a cementing, fracturing, or acidizing job can often improve results from the subsequent operation for increased profits. Here are some Halliburton chemicals designed to clean wells efficiently and economically:

MCA serves as an effective remover of "skin effect" caused by drilling muds on a formation face. It is a first stage completion fluid adaptable for all types of formations. Halliburton Mud Cleanout Agent combines two components – a high concentration of blended organic surfactants, Morflo II, and a suitable concentration of Regular HCl. The HCl tends to shrink bentonitic clays and dissolve carbonates in the mud while the surfactant helps disperse mud particles, provide penetrating properties, and help break viscous emulsions.

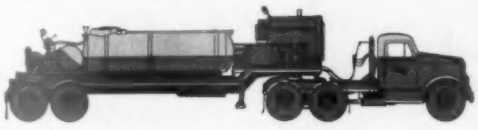
Mudflush – a non-acid mud remover with blended organic surfactants. Morflo II – aids in cleaning wells without corrosion of well equipment. Using this water-base solution as a stage between a cement column and drilling mud helps prevent cement contamination. Mudflush won't chemically react with acid soluble formations.

Oilsperse – an oil base solvent containing dispersing and thinning agents for removing most types of water or oil base drilling muds from the well bore – helps particularly in loosening drill pipe stuck from differential pressure. It removes large amounts of fluid mud from the well bore and shouldn't remove filter cake from possible lost circulation zones.

HF Acid aids in cleaning sand formations and has low surface tension properties for better formation penetration and flow. HF Acid – a mixture of hydrochloric and hydroflouric acids – also improves injectivity in water injection and disposal wells completed in sand reservoirs. The hydroflouric acid has silicate dissolving properties.

Cleanout well bores for all these benefits – call your Halliburton man to assist you in selecting the exact agent for your well conditions!

Clean wells chemically



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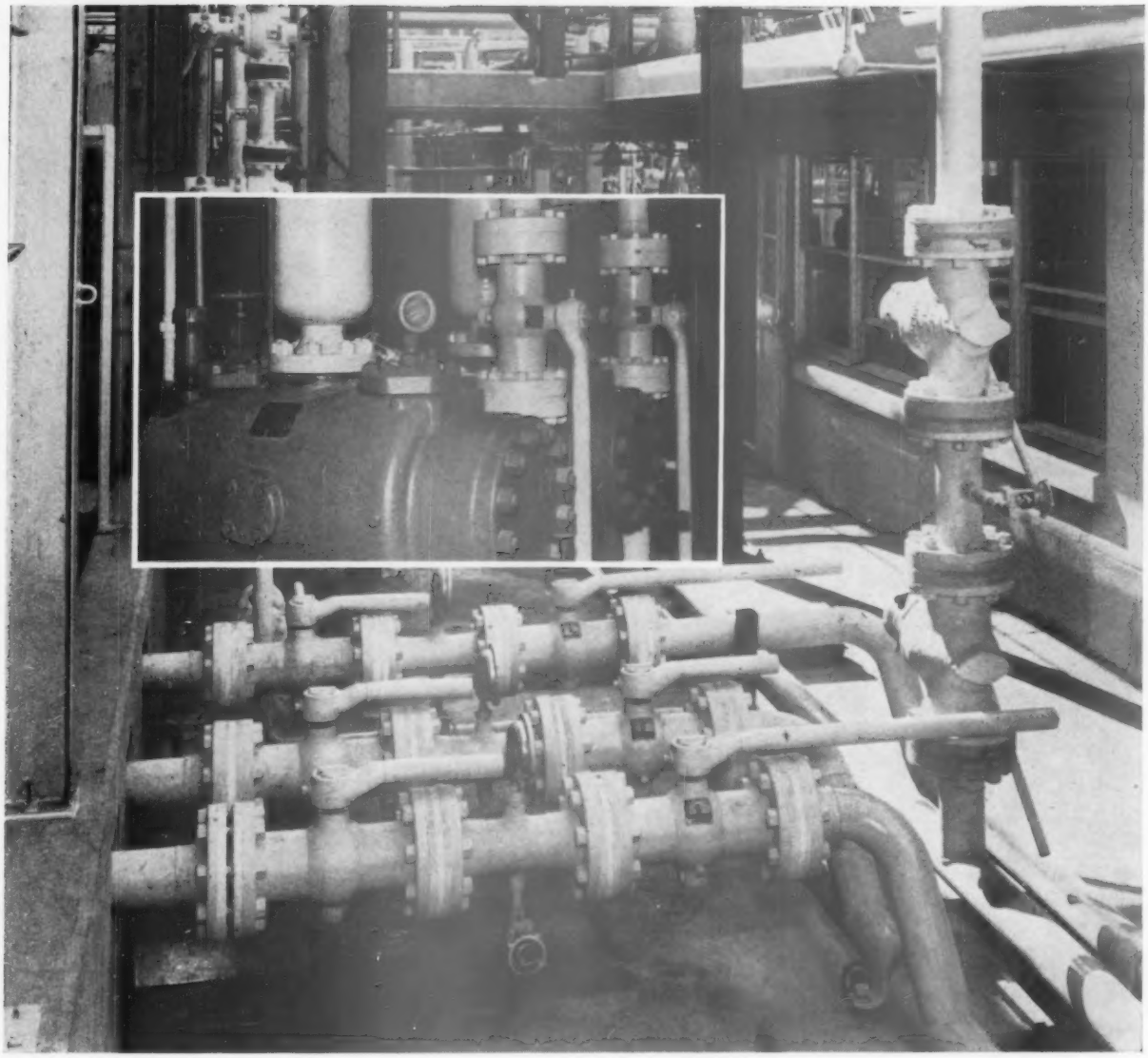

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Cameron Ball Valves can be made of materials best suited to your needs, whether your problem is the handling of acids, alkalies or abrasives. Cameron's unique method of fabrication permits the use of exotic materials.

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Cut disconnect-reconnect time by as much as 50%

The FALK Spacer Coupling is specially designed for quick installation or removal *without disturbing the driving or driven unit.* This feature can save you up to 50% in disconnect-reconnect time when critical equipment—a process pump, for example—needs repair or replacement.

Here's another saving: with the FALK Spacer Coupling, you can quickly realign shafts *without the usual loss of operating temperature!*

And still another: you can remove or reinstall the FALK Spacer as a unit *without draining the lubricant.*

Because of its exclusive grid-groove Steelflex design, the FALK Spacer can accommodate residual misalignment—parallel, angular, or (most important) *both.* Also, it provides torsional resiliency that cushions shock and vibration. Thus it saves wear-and-tear on your connected equipment.

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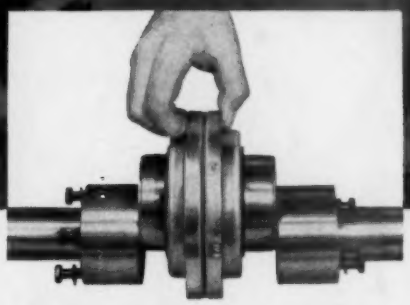
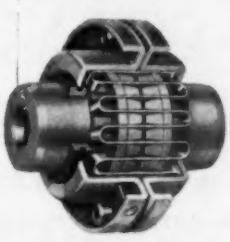


EASY AND QUICK TO INSTALL, DISCONNECT OR RECONNECT

First, mount shaft hubs to allow proper distance between hubs; then, align driving and driven units.

Second, compress Spacer to fit space between hubs and tighten cap screws to pull spacer hubs into the registered fit.

To disconnect, reverse the second step. No draining of lubricant necessary.



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...a good name in industry

The Naylor Lockseam Spiralweld structure provides maximum strength and minimum weight—two important specification characteristics in Naylor Surface Casing. The external raised spiral helps to centralize your Naylor Casing in the hole —and insures better cement jobs. Naylor is available with either slip joint or threaded and coupled ends. For application details, form specifications or test data, call your nearest Mid-Continent representative.

NA2-1

MID-CONTINENT SUPPLY CO.

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

Mid-Continent Building, Fort Worth, Texas • Export Division: 45 Rockefeller Plaza, New York 20, N.Y. Cable: MIDCUMPORT NYK

Photographed at DX Sunray, (Tulsa Refinery)

For higher yield...new Aerocat 3C

CAN YOU USE a higher yield of gasoline—? or of propylenes or butylenes—? Then investigate the new AEROCAT 3C! It's a new fluid cracking catalyst composition, developed by Cyanamid in cooperation with a major oil company. AEROCAT 3C-12 gives increased gasoline yield . . . AEROCAT 3C-20, increased propylene and butylene yields . . . both at the expense of dry gas and coke.

In actual commercial operations, these new three-component catalysts have proved their ability to provide refiners with more flexible, more profitable operation. They are highly active, exceedingly stable, and completely operative.

Your "Man with the Golden Rule"—your Cyanamid salesman—will be glad to work with you to determine the suitability of AEROCAT 3C for your needs. He knows catalysts—and behind him are the resources of a major producer of both catalysts and other chemicals. Why not call him now?

Basic in catalyst chemistry

CYANAMID

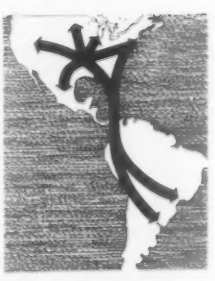
AMERICAN CYANAMID COMPANY • REFINERY CHEMICALS DEPARTMENT • Bound Brook, New Jersey

Braniff's On Time . . . As Usual!

Some of our friends say you can tell time by Braniff planes flying overhead. Perhaps a mild exaggeration . . . but government statistics prove Braniff is a leader in on-time records.

"On-timeliness" is just one of many Braniff bonuses. Consider, for example, our Silver Service meals . . . the "looked-after" feeling you get from charming Braniff hostesses . . . and all the other friendly Braniff folks who serve you from start to destination. Yes, and the luxury of Braniff's new El Dorado Super Jets.

Men in the oil and gas industries also appreciate our extensive schedule of jet flights between Texas and New York, Chicago, Denver, and Mexico. Actually, Braniff serves 50 U.S. cities, and from Texas or New York/Miami (via Braniff-Eastern thru-jet service), 10 Latin American countries.



FLY BRANIFF TO THE API CONVENTION IN CHICAGO NOVEMBER 12-15

BRANIFF *International* **AIRWAYS**

General Offices: Dallas, Texas

Mr. Drilling Contractor

Your Pressure Worries Are Over!

Goodall proudly announces
two ALL-NEW rotary hose
S-7500 Super Long-Life
...and the revolutionary
S-10,000 ULTRA Long-Life

Goodall, first with every worthwhile rotary hose development, now puts an end to your pressure worries with two completely new types of hose. You've heard about this amazing hose from your friends. Now, with complete performance data and a full supply of hose, we can offer Goodall S-7500 Super Long-Life and S-10,000 ULTRA Long-Life Rotary Hose for sale through your supply store.

Goodall S-7500 Super Long-Life is a premium cable hose at the regular price. It is **the** rotary hose for working pressures up to 4000 lbs.

For working pressures above 4000 lbs., you need the new ULTRA Long-Life hose. It costs more to make, it costs more to buy—but it's worth every penny. Supply is limited; please order ULTRA Long-Life cable hose in advance of your needs. Available in 3″ hose sizes only.

These new Goodall rotary hose are products of years of research and equipment development. Manufactured with completely new machines, they are masterpieces of perfect balance. The type of cables, the angle of the cables, gasket materials, weight of couplings—all are new.

Now you can use the high pressure capacity of your pumps, or conform to oil company test procedures, without a worry about exceeding the rotary hose working pressure. And, because these hose have substantially more reserve strength, they give you **bonus longer life.**

You always get the advantages of the Goodall unconditional one-year guarantee, the famous Barney Coupling, the Goodall Safety Clamp and the Goodall Repair Service. Call your favorite supply store and specify Goodall!

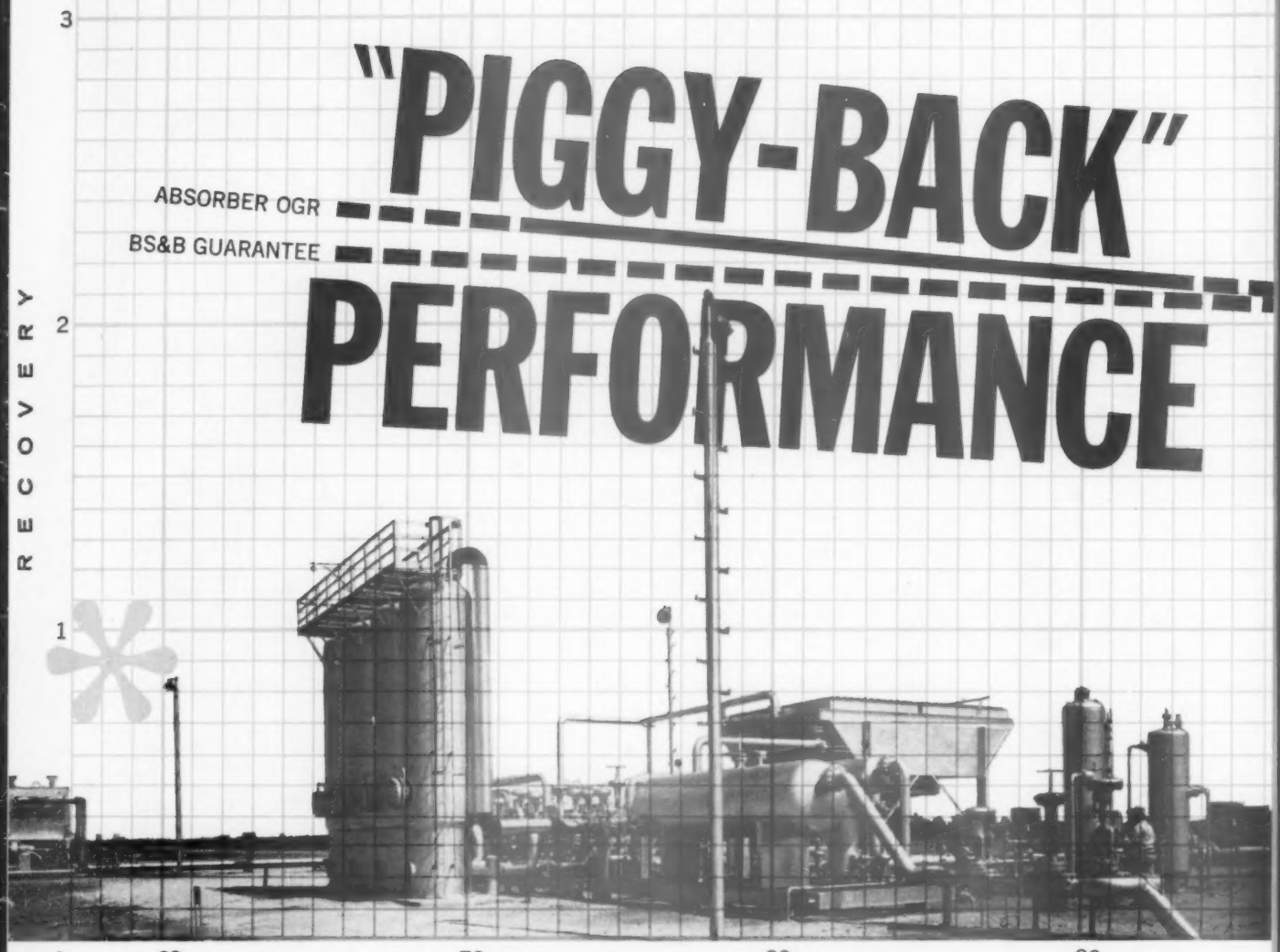
Goodall has been first with every worthwhile rotary hose development

GOODALL
RUBBER COMPANY

A TRIBUTE TO BARNEY

On the occasion of the introduction of this great hose, Goodall Rubber Company gratefully salutes H. "Barney" Barnard for more than a quarter-century of dedicated effort to industry-wide rotary hose improvement.

"PIGGY-BACK" PERFORMANCE



Look at the liquid recovery curves for this BS&B DRY FRAC Unit. Actual recovery rate slightly exceeds and parallels the guarantee so closely we will call it "piggy-back" performance. This takes real process know-how.

Lean streams, rich streams, sour or sweet... BS&B has the equipment to handle them all. Glycol or dry desiccant dehydration. Desulfurization or CO_2 removal. Low temperature separation with natural, mechanical, or ammonia absorption refrigeration. Or cold feed stabilization.

The economics of YOUR situation will dictate selection of the proper equipment for the highest rate of return and quickest pay-out.

Want to discuss your gas processing requirements in preparation for the big gas demand ahead? Call your nearest BS&B sales office, or write to Black, Sivalls & Bryson, Inc., Box 1714, Oklahoma City, Okla.

The new BS&B "Uniflux" Heat Exchanger is an important component of this DRY FRAC Quick Cycle Hydrocarbon recovery unit. Instrumentated with completely automatic controls to assure safe, efficient operation, "Uniflux" heats with high temperature inert gas with no flame impingement on tubes. Fast response to heat and cooling loads make it ideal for intermittent service.

Manufacturers of: Oil and Gas Field Processing Equipment, Control Valves, Safety Heads, Electronic Instrumentation, Heat Engineering Equipment, Mass Flowmeters, Filament Wound Glass Fiber Products, and Grain Storage and Processing Equipment.

1-A10

BS&B

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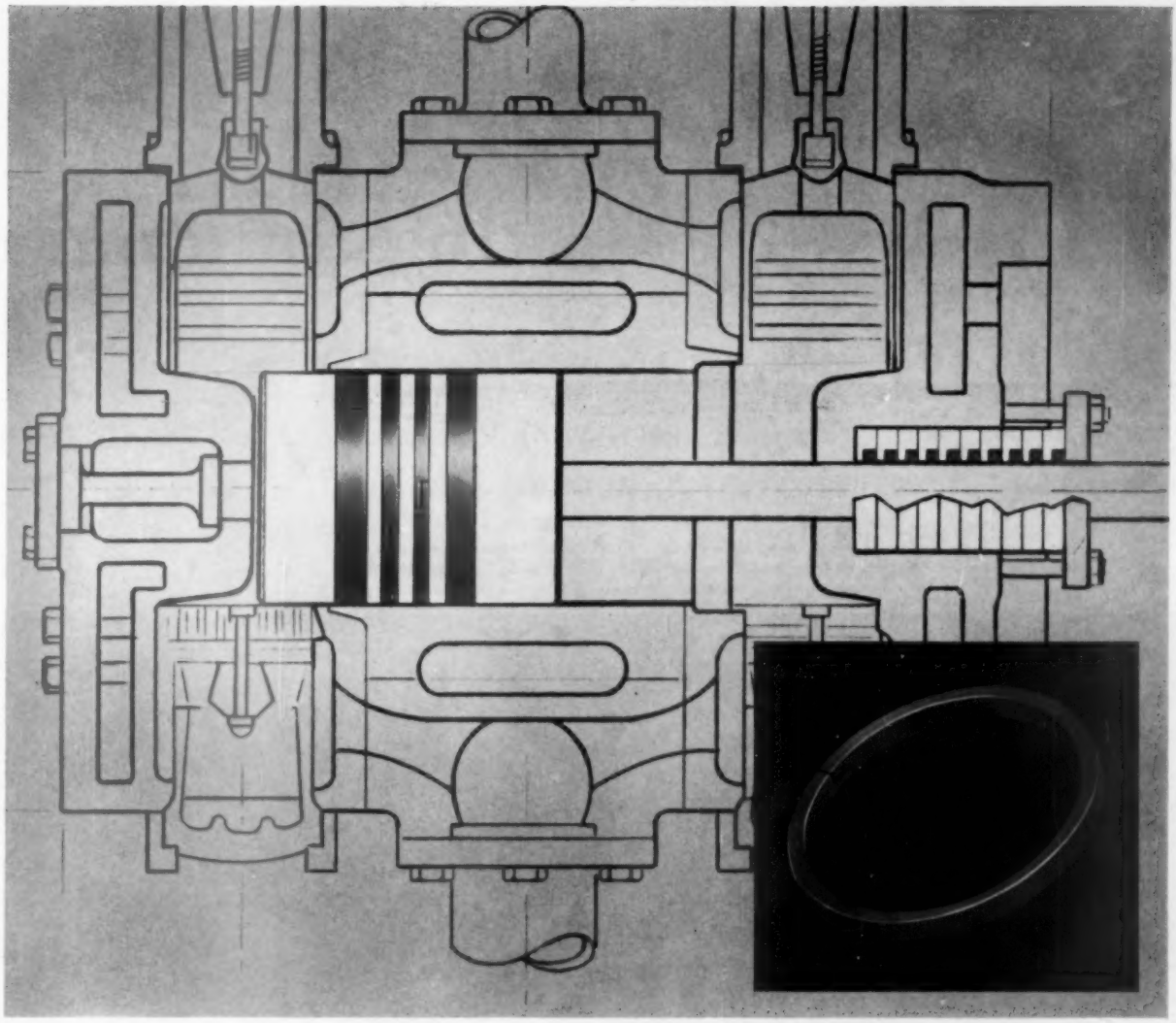

How piston rings of TEFLON® eliminated fire hazard and saved $4,500 per year

Oil contamination in an instrument air system caused serious problems in a large manufacturing plant. Oil plugging the lines not only led to heavy maintenance costs, but also created a dangerous fire hazard. Converting the eight instrument air compressors to piston rings of TEFLON solved the problems and saved the plant money.

The greatly reduced lubrication required with rings of TEFLON (no oil at all was added to the cylinder) eliminated the oil contamination and system plugging. In addition to cutting maintenance costs substantially, the rings of TEFLON lasted longer than previously used carbon rings, saving $3,000 per year in ring cost, and virtually eliminated cylinder wear, saving another $1,500 in cylinder refinishing.

Piston rings of TEFLON are your most logical and economical choice whenever reduced lubrication would be desirable . . . whenever problems of product contamination arise . . . whenever ring brittleness causes handling, installation, or operating difficulties. If you are buying a new compressor, specify rings and packings of TEFLON TFE resin. To convert your present equipment, check with your compressor manufacturer or qualified ring supplier for engineering and design assistance. For more information write to: E. I. du Pont de Nemours & Co. (Inc.), Dept. OG-10, Room 2526, Wilmington 98, Delaware.

In Canada: Du Pont of Canada Limited, Box 660, Montreal, Quebec.

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TEFLON®
FLUOROCARBON RESINS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resins.

Making ammonia

One of two 1500-hp Ingersoll-Rand KVGA turbocharged gas-engine compressors at Federation Chemicals Limited in Point Lisas, Trinidad. Each unit compresses 591 cfm of ammonia synthesis gas in four stages to 5000 psi.

under tropical skies

Five types of I-R compressors handle all processes in new Trinidad ammonia-urea plant

The new ammonia-urea synthesis plant of Federation Chemicals Limited, managed and operated by W. R. Grace & Co., has gone into production at Point Lisas, Trinidad, with five different types of Ingersoll-Rand reciprocating compressors handling all air and gas applications. The startup was successful and on time – typical of I-R equipment and service.

The I-R equipment includes two 1500-hp KVGA turbocharged gas-engine compressors handling synthesis gas in four stages at 5000-psi discharge. Two 330-hp SVG gas-engine units compress carbon dioxide to 3000 psi, and two 660-hp SVG's handle ammonia refrigerant and air. A 75-hp electric-driven ESH horizontal compressor provides 100-psi general-service air, and a 40-hp ESH supplies instrument air. A single-stage 183-hp electric-driven HHE circulator operates at 4700-psi discharge. There is also a 10-hp Type 30 single-acting air-cooled compressor.

The Trinidad plant employs 15 Ingersoll-Rand centrifugal pumps on various services.

Ingersoll-Rand equipment may be found in all types of jobs, around the world. I-R offers the most complete line of compressors, in reciprocating, centrifugal, rotary and ejector types. There are units from ½ to 20,000 hp, for pressures from one micron to 35,000 psi. I-R is also the world's biggest builder of centrifugal pumps. Your I-R man can give valuable help with your process – call him today.

Ingersoll-Rand

153A14 ▼ 11 Broadway, New York 4, N. Y.

Two Ingersoll-Rand ESH motor-driven compressors at Federation Chemicals. The 40-hp unit at left supplies air for instrumentation, and the 75-hp unit at right provides 100-psi general plant air.

Two 330-hp SVG gas-engine compressors handling carbon dioxide. A cylinder of a 660-hp SVG which handles ammonia refrigerant and air can be seen at right. In the background are the KVGA's.

O·C·T presents three new hangers

for the C-22 Casing Head

The new O·C·T C-22 casing head accepts a family of three new heavy-duty, interchangeable hangers. This straight-bore casing head is designed to support maximum loads.

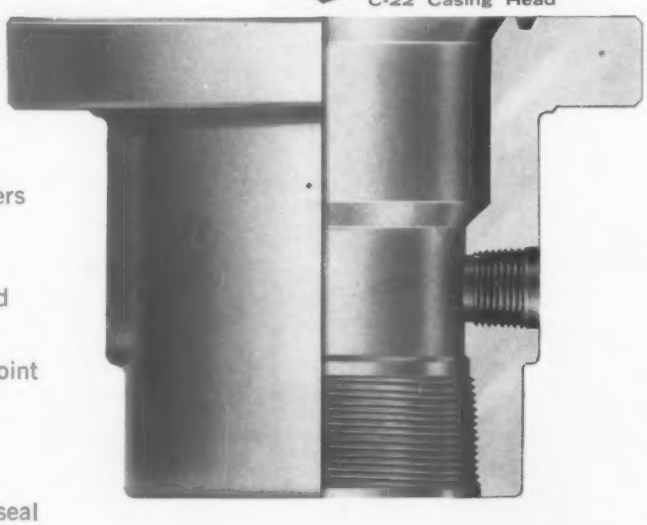
Hangers designed for the C-22 casing head include the C-21, C-21-W, and C-22. All three hangers are interchangeable with each other and with O·C·T's tubingless completion hangers. These hangers feature O·C·T's improved slips that hold extreme loads without crushing the casing.

Each hanger can support weight beyond the joint strength of the pipe iself, with minimum casing deflection. All three can be lowered through blowout preventers.

- **C-21 casing hanger:** slips, slip bowl, and floating seal ring that provides positive annulus packoff.
- **C-21-W casing hanger:** welded-to-casing version of the C-21.
- **C-22 casing hanger:** single-unit sealing element, slip bowl, and slips; automatic seal; spring-loaded latch.

See your nearby O·C·T representative for further information, or write to Oil Center Tool Company, P. O. Box 3091, Houston, Texas.

C-22 Casing Head



where progress is a daily practice

O·C·T

OIL CENTER TOOL CO.

SUBSIDIARY OF FMC CORPORATION

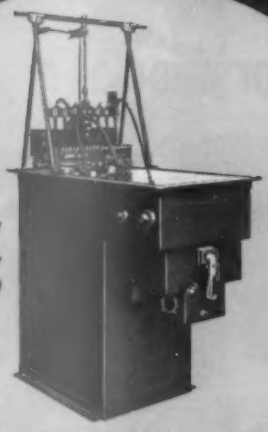
Address Export Inquiries for All Countries to P. O. Box 3091, Houston, Texas

EC&M's LINE OF HIGH VOLTAGE STARTERS GIVES YOU

*EXACTLY the Right Starter for Any Location!**

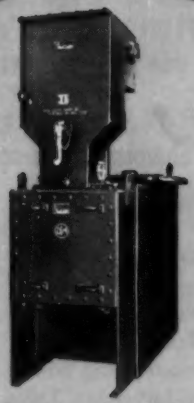
* Hazardous Location, Class I, Group D, Divisions 1 and 2

TOTALLY OIL-IMMERSED



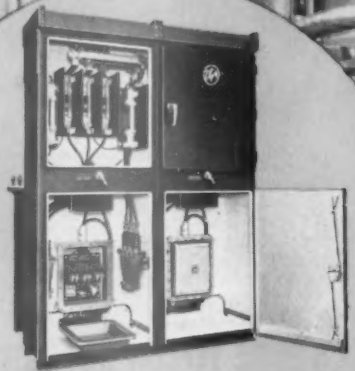
Type AT Combination Starter shown with Contactor and Overload Panel raised above the oil level without disconnecting any bolts or leads—in NEMA 3R enclosure for outdoor mounting, available in 50,000 KVA (certified) interrupting capacity.

OIL-IMMERSED



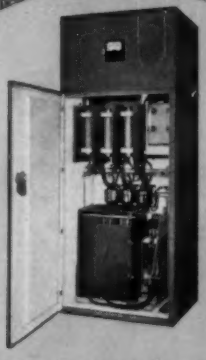
Type AM Combination Starter in NEMA 3R enclosure for indoor or outdoor locations—available in 50,000 KVA (certified) interrupting capacity —and VALIMITOR.®

OIL-BREAK



Type AH Combination Starter in NEMA 1 or 3R enclosures for indoor, outdoor or pressurized control room—available in 3 interrupting ratings, 50,000 KVA—POWER FUSED—and VALIMITOR.®

AIR-BREAK



Type AFG Combination Starter for Pressurized Control Rooms. Built in Class E1, Class E2 and VALIMITOR.®

For complete information write for Bulletin 8131-L

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7928-R

ENGINEERING

NEWS YOU CAN USE ABOUT ENGINE AND COMPRESSOR PERFORMANCE

TEFLON* COMPRESSOR RINGS... for special applications

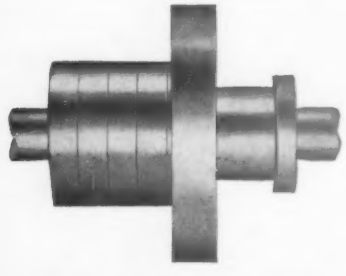
- **TEFLON eliminates or minimizes compressor lubrication**
- **TEFLON is inert to most harmful chemicals and solvents**

Cook-engineered Teflon packing and piston rings now make it possible to reduce or completely eliminate compressor lubrication. Because of its extremely low coefficient of friction—its toughness and resiliency—Teflon is suitable for both lubricated and non-lubricated ring service.

And just as important, Teflon is completely inert to most chemicals and solvents—thus prevents costly product contamination or other damage which might result with ordinary ring materials.

If your special processing applications demand "borderline" compressor lubrication, you'll want to investigate Cook's Teflon rings. You can get them any size. And they are available in many special Teflon blends, depending on your application. Ask a C. Lee Cook representative to give you the details.

**Teflon is a du Pont product of tetrafluorethylene resin.*



NEW PACKING DESIGN TAKES HEAT OFF TEFLON RINGS

This unique packing design now being developed by Cook keeps Teflon rings cool! It is a new idea for application where Teflon's qualities are needed, but where normal operating conditions develop too much heat for conventional designs.

SEND FOR FREE 6-PAGE TEFLON BOOKLET

If you would like more complete information about new Teflon packings and Teflon piston rings for your specific applications, just write: C. Lee Cook Division, Dover Corporation, 934 South 8th St., Louisville 3, Ky.

C. LEE COOK

DIVISION OF DOVER CORPORATION

Rings and Packings Since 1888

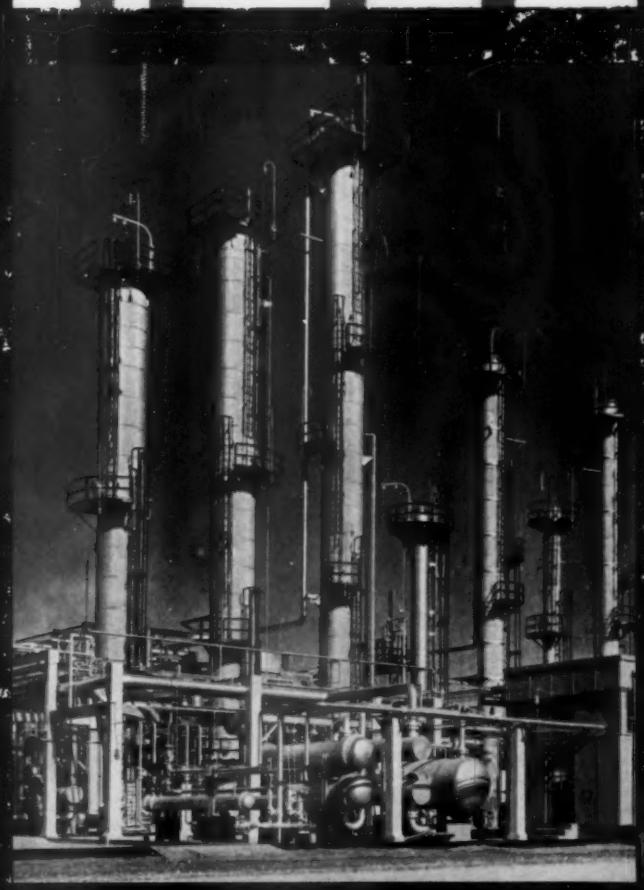
21 Procon-built plants meet benzene demand

The growth of the plastics and synthetic fiber industries has created an increasing world demand for benzene. To help meet this requirement Procon has built or is completing 21 plants . . . in every section of the United States . . . as well as other free world locations such as Germany, Brazil, Canada, The Canary Islands and Australia.

■ Typical of Procon's petrochemical construction, these benzene plants provide adaptability and versatility through the incorporation of the Udex and/or Hydeal processes. Udex permits the recovery of high-purity benzene and other aromatics from petroleum hydrocarbon mixtures . . . while Hydeal allows production of benzene from toluene and xylenes for greater economic flexibility.

■ If you require construction in the chemical, petrochemical or petroleum refining industries . . . no matter what the process, the product or the location . . . Procon can do the job . . . complete it on or before the agreed date . . . to your satisfaction.

■ Why not call us for the full story?



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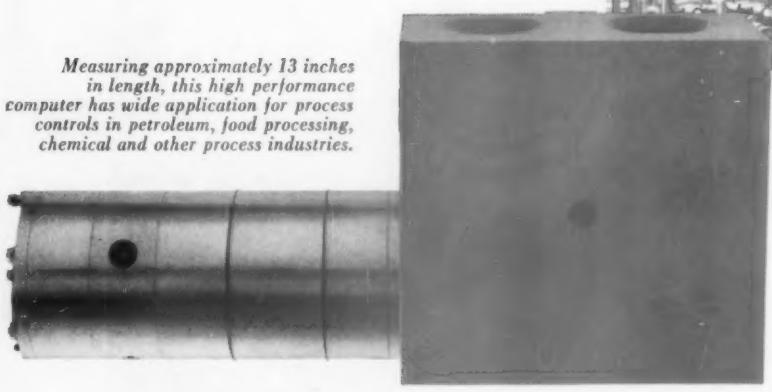
AiResearch introduces pneumatic computer to the process industry



Measuring approximately 13 inches in length, this high performance computer has wide application for process controls in petroleum, food processing, chemical and other process industries.

Provides control accuracy within 1%

- ***Performs all necessary mathematical functions***
- ***Utilizes existing plant instrumentation***
- ***Can receive and transmit electrical signals***
- ***Comparative low costs assure rapid pay-out***
- ***The building block technique of modular construction assures flexibility to cope with problem changes.***

The AiResearch Pneumatic Analog Computer
is the next evolutionary step in process control. It assures continuous on-line solution within one percent overall accuracy of expressions or equations requiring as many as 10 or more mathematical functions.

AiResearch can (a) mechanize your control expressions, (b) assist you in formulating the control expressions and mechanize them, or (c) present you with a packaged system.

This industrial computer system is a result of more than 20 years of experience by AiResearch in the design and manufacture of pneumatic, hydraulic and electronic control systems and components.

• Please direct inquiries to Controls Systems, AiResearch Phoenix Division

THE GARRETT CORPORATION

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Systems and Components for: AIRCRAFT, MISSILE, SPACECRAFT, ELECTRONIC, NUCLEAR AND INDUSTRIAL APPLICATIONS

40 GROVE G-5 GATE VALVES USED IN SHELL'S MANIFOLD MODERNIZATION

One of four Shell oil-gas gathering system manifolds at Gibson, La. Forty 3" Grove G-5 ASA series 150 Seal-"O"-Ring Gate Valves.

In modernizing its Gibson, La., oil-gas gathering system manifolds, Shell Oil purchased Grove series G-5 gate valves. These valves feature Grove Seal-"O"-Ring® design—the "double-barrier" sealing system. First, there's positive metal-to-metal seal of inner seat rings against a parallel sided gate. Second, the sealing and squeegee action of protected o-rings that keep the gate clean and smooth for fast, easy open and close. Other G-5 features: extremely compact, round opening, kanigan coating to resist corrosion. And the big plus: Grove G-5 gate valves eliminate all maintenance costs relative to lubrication!

Call or write for a complete Grove G-5 valve presentation

GROVE VALVES

GROVE VALVE AND REGULATOR COMPANY

A subsidiary of Walworth

6529 HOLLIS STREET • OAKLAND 8, CALIFORNIA

Offices throughout the U.S. and in Western Canada

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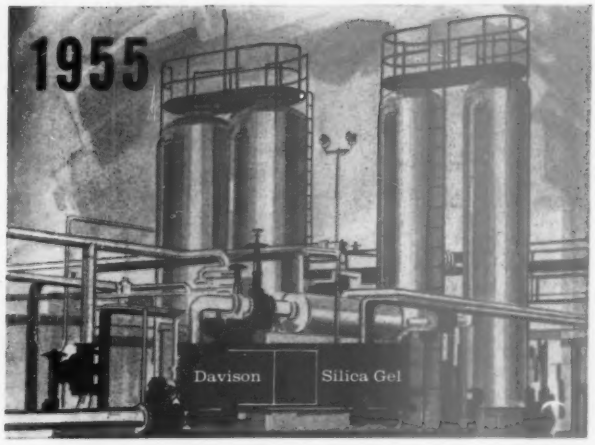

Because it can actually repay its cost . . .

Davison Silica Gel for natural gas drying has more than tripled in use in only 6 years!

Last year over three times as much Davison Silica Gel was installed in natural gas drying operations as was sold in 1955! 320% increase . . . in only 6 years. The growth hasn't stopped yet. More and more natural gas processors are switching to Davison Silica Gel.

Why? Davison Silica Gel can actually repay your cost of natural gas drying with recovery of valuable hydrocarbons. The large surface area and pore volume of Silica Gel attain recovery efficiencies up to 95%, producing as much as 3 gallons of usable pentane-plus per 100 pounds of Davison Silica Gel.

Regeneration is easy and almost total. Some installations are still on stream without change after seven years, others three or more. For natural gas drying, hydrocarbon recovery, drying of cracked refinery gases, ethylene and propylene, Davison Silica Gel's high purity and greater capacity make it the ideal desiccant. For complete information, write today:

GRACE

DAVISON CHEMICAL

Industrial Chemicals Dept. 3110
Baltimore 3, Maryland

IT'S THE PROTECTION THAT COUNTS WITH A TOOL JOINT COMPOUND

No-Gall contains more than 50% pure metallic zinc, for those who prefer a zinc base compound. It is used on the longest strings with complete safety. SIZES AND WEIGHTS: 2½ gal. 38 lbs.; 5 gal. 75 lbs.; 15 gal. 225 lbs.

Lo-Tork has a finely screened metallic lead base. It has a low coefficient of friction and highest fluidity consistent with body required. SIZES AND WEIGHTS: 2½ gal. 38 lbs.; 5 gal. 75 lbs.

When ordering a tool joint compound, remember it's protection for the threads that you are buying. And for this purpose WECO No-Gall or Lo-Tork are the finest compounds you can use.

They spread completely around the threads but will not harden or squeeze out under high pressure or temperature. They remain soft in the can at all temperatures and in all weather for easy application. Finely screened pure metallic zinc or lead is dispersed in a neutral oil with a tacky additive to give you the kind of thread protection you need. WECO Compounds never require thinners and are not affected by extremes of hot or cold weather.

Dope your string right . . . with a WECO Compound. Available from supply stores everywhere.

Also ask your supply store for WECO Hi-Speed Seal; WECO Steel-Aid and WECO-API Hi-Pressure thread compound to be sure of leakproof connections and positive thread protection for all oil field threaded connections.

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WELL EQUIPMENT MFG. CORP.
P. O. BOX 19465 • HOUSTON 24, TEXAS
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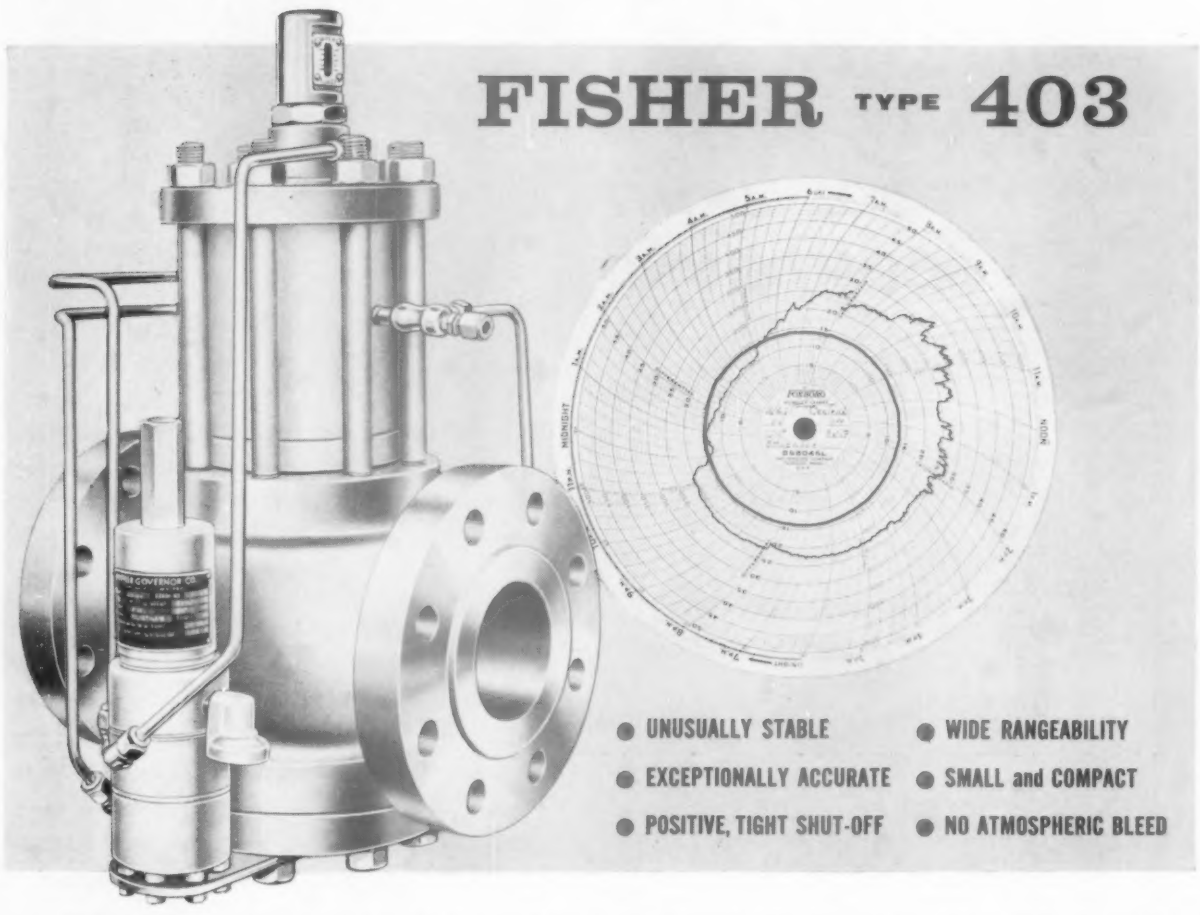
Revolutionary high pressure gas regulator...

ASSURES UNIFORM DOWNSTREAM PRESSURE IN SPITE OF DEMAND EXTREMES



"Boy, you should see what a perfect job that regulator is doing!"

These are the words of an official of a southern transmission company after watching the results accomplished by the Fisher Type 403 in a large compressor station. The 403 is especially designed to solve the gas man's frequent problem of maintaining uniform downstream pressure, regardless of extremes in differential pressure.

The chart above is a 24-hour recording of changing gas demands and simultaneous performance in which a 4-inch Fisher Type 403 regulator was used in a large town border station. Controlled flow ranges of 1½ to 3 million SCFH were charted. Inlet pressure was 350 to 750 PSI—outlet pressure 140 PSI.

This unusually stable control under all flow conditions is possible because the Type 403 inner valve is positioned by a piston, which makes full use of inlet pressure to balance the inner valve. Full inlet pressure can be applied to downstream side without danger of damage or overstress.

The Type 403 shuts off dead tight. Even with pressure drops to 1000 PSI there is very little build-up in downstream pressure. Can be disassembled and assembled in less than half an hour without removing body from the line. It's the ideal regulator for your town border or compressor stations.

WRITE TODAY FOR BULLETIN P-403 CONTAINING COMPLETE DETAILS AND SPECIFICATIONS

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD... CHANCES ARE IT'S CONTROLLED BY...

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / Rochester, England

BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIP. CO., CORAOPOLIS, PA.

FISHER® Controls

SINCE 1880

Minute

These are the men who

REDUCE YOUR COSTS

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Kansas

Louis Sears
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Wyoming

Enid Duggins
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Minute-men are factory trained service men.

Interested in your service requirements.

Needless parts and repairs are eliminated because of their past service experience.

Unnecessary shut down time eliminated.

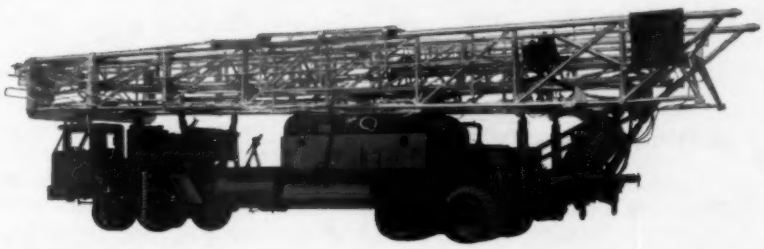
Trained service men don't guess — they know.

Efficient controlled steps reduce your service costs.

Maintenance requirements reduced by minute-men servicing.

Economical service because minute-men are economy minded.

Net profits protected because properly serviced units have a longer life.



Use First Class Service
for First Class Servicing Units

WELL SERVICING AND DRILLING UNITS
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CABOT CORPORATION
MACHINERY DIVISION

FISCHER & PORTER

INSTRUMENTS THAT MEASURE AND CONTROL FLOW, TEMPERATURE, PRESSURE, &c., &c., &c. have established their reputation for superiority against all competitors through the years. In the realm of fluid flow measurement, Fischer & Porter Company is the

ONLY COMPLETE FLOWMETER HOUSE

We solicit your attention to the outstanding examples noted herewith.

THE HANDIEST GUIDE TO THE VARIOUS AND SUNDRY METHODS PRESENTLY AVAILABLE FOR MEASURING FLOW

It has been our pleasure and profit over the years to aid and assist divers engineers in the estimable task of selecting the one—nay, the *only* device best suited to measuring a given flow. But truly, the years have added, the devices have multiplied, and the task of selection has grown ever more complex. As a result, the "handy" guides, so reminiscent of an earlier day have grown less handy all the time. Let us see how handy we can be.

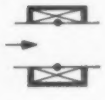
LESSON I

There are but four major types of flowmeters.

1. VARIABLE-AREA

2. VARIABLE HEAD

3. OBSTRUCTIONLESS



4. INTEGRATING

LESSON II

In order to be as handy as possible, we shall limit our discussion of the advantages of the four basic types to a single characteristic benefit.

1. Variable-Area: linear scale
2. Variable Head: flexibility
3. Obstructionless: obstructionless
4. Integrating: accuracy

LESSON III

This lesson is of the most importance as it concerns the various factors necessarily involved in the judicious selection of flowmetering devices. These primary and critical factors are: fluid property limitations, application, installation and economics. We need not go into detail on these factors since our Bulletin 91-119, a veritable gem of condensation, reviews all of these factors in the short space of only six pages. There is a limit as to how short and "handy" such a guide can be.

If you are one of those, and there are many, who philosophically opposes all "handy" guides, then we need only remind you that we make all of the four major types. Indeed, we are the only company to do so. We also wish to state that we use a wide variety of materials to construct these meters including many readout and process control devices. Our laboratories include the finest and most advanced flow measuring and calibrating equipment. A call to our field engineers can save you trouble and bring you a firm recommendation unencumbered by bias or prejudice.

TO THE RIGHT

is a sampling of some outstanding examples of each type of meter in our flowmetering line.

Variable-Area Flowmeters

Fischer & Porter has indeed made its mark in lands far and wide as the leading manufactory of variable area meters, finding itself pleasantly faced with such wide acclaim for ease of use and simplicity that it defies description. Yea, and to no surprise. Indeed our people have labored unceasingly to INTRODUCE EVERY MAJOR ADVANCE in this noble form of flowmetering, to wit: the glass tube that allows viewing the rate of flow directly; the bead-guide and Tri-Flat meter for matchless float stability; the predictable float which simplifies calculations; the metal tube for high pressures and temperatures.

Frictionless! Foolproof!

—herald the fortunate employers of the MAGNABOND coupling developed by Fischer & Porter for detecting the linear motion of the float, with abundant power to operate a multitude of accessories for recording, transmitting, totalizing and controlling. The ingenious detection system employs permanent magnets sealed into a non-magnetic, corrosion-resistant extension unit, and is widely used in conjunction with the popular FLOW-RATOR meters.

The NEW, ALL NEW

MAGNARATOR

with

FLOW INDICATOR

and

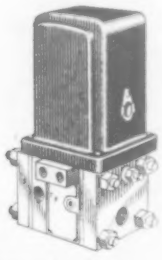
PNEUMATIC TRANSMISSION

This amazing apparatus is distinguished as the TRUE in-line, through-flow meter. Of great joy to installation and maintenance men alike, no extension is needed and there are no

crooks, crannies or corners where material can collect. The MAGNARATOR, kin to the extension-type MAGNABOND flow transmitter, is lofted to great heights of applicability by a new magnetic coupling principle. It measures, indicates and transmits pneumatically with a linear output signal!

Variable Head Flowmeters

...featuring the



DP TRANSMITTER

by the wizards of Warminster

FISCHER & PORTER

Outwits PULSATION!
Outwits CORROSIVE FLUIDS!
Outwits STEAM TRACING PROBLEMS!

This popular differential pressure transmitter undeniably supports its claim as being the best in the world. Since it was first presented to the metering public its success has been remarkable. WHY? Its superiority over all others is substantiated by the FACTS OF ACTUAL USE!

ASTOUNDING ADVANTAGES

found in no like instrument

ADJUSTABLE DAMPING in the differential sensing system, Gentlemen, which is where it should be. We warrant there to be no other method that lets you measure PULSATING flow without zero shift, PHANTOM signals, diaphragm fatigue or premature parts failure.

NEW METALS & ALLOYS such as Tantalum, 316 Stainless and Monel are STANDARD materials of construction for the sealing DIAPHRAGMS. Other "wetted" parts are fabricated from 316 Stainless, Monel, Nickel and Hastelloy C—as you desire. A perfectly sealed measuring chamber filled with the celebrated silicone oil PROTECTS ALL WORKING PARTS.

INTEGRAL STEAM TRACED PROCESS FLANGES, available from our shipping shelves, enables one to conveniently heat process connections to prevent fluids from "freezing"—all without TROUBLESOME AND EXPENSIVE lagging and tracing in the field.

Obstructionless Flowmeters

THE JUSTLY CELEBRATED MAGNETIC FLOWMETER

OF FISCHER & PORTER
one of the very best
instruments ever invented

An unobstructed length of pipe that accurately measures the flow of even the least conductive fluids by the Invisible MAGNETIC FIELD. Extends the range of accurate flowmetering to heretofore unbelievable limits. A rangeability of 3000:1! Measures the flow of any liquid with a conductivity of no less than 0.1 micromho per centimeter.

Measures flow IN EITHER DIRECTION and without auxiliary equipment. Handily provides full scale recording of ANY FLOW RATE from 1 to 30 feet per second at the TURN OF A DIAL.

Coupled with a

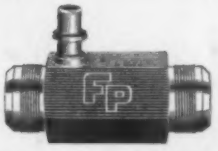
Fully Transistorized Recorder

Years ahead of its time! An instrument of the future which you can profitably use today. The new recorder incorporates compact transistorized circuits which have reduced space requirements incredibly. Now the entire instrument is contained in a SINGLE DEPTH CASE. No black boxes to add. All amplifiers are mounted on plug-in cards.

Gentlemen, the Magnetic Flowmeter itself represents the GREATEST ADVANCE in flowmetering in the last quarter century!

YOUR ATTENTION INVITED!

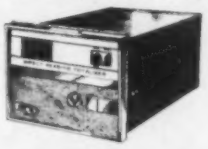
Integrating Flowmeters



TURBINE METER

Here is the zenith in flowmetering of the greatest accuracy over a wide range, designed for the most fastidious users. Each and every revolution of the bladed rotor in the TURBINE METER signifies the passage of a definite unit of fluid volume with an ELECTRICAL pulse. The total number of counts is proportional to the total volume of FLUID PASSING THROUGH the meter.

NEW ! NEW ! NEW



TRANSISTORIZED
READOUT DEVICES

The Turbine Meter can be linked with any of an unbelievable number of Readout Devices to oversee your process operations. Exemplary devices, utilizing the most up-to-date transistorized electronic components and techniques can indicate, totalize, record and control.

Continuous In-Line Blending

NOW A FACT

Triumph at last. To the marriage of the amazing Turbine Meter and Marvelous Electronic Readout Devices goes a new distinction. Together they have brought to reality a truly Continuous IN-LINE BLENDING System for blending of two or more fluids. This combination offers to you many other solutions for conquering DIFFICULT & DEMANDING & COSTLY flowmetering operations.

STATE YOUR PLEASURE, GENTLEMEN!

To better acquaint our public with the BENEFITS and ADVANTAGES of our UNIQUE products we have caused to be printed handsome booklets for the general edification. We will gladly post to you a selection of these works upon your application. It will only require an expression as to the type of meter(s) of interest, that is Variable-Area, Variable Head, Obstructionless and Integrating and also our "handy" Guide (91-119). We are your obedient servants in this as in all other matters.

FISCHER & PORTER CO.
WARMINSTER, PENNSYLVANIA & TORONTO, CANADA

A world-wide INSTRUMENT COMPANY with plants in Australia, England, France, Germany, Holland, Mexico, as well as the U.S.A.

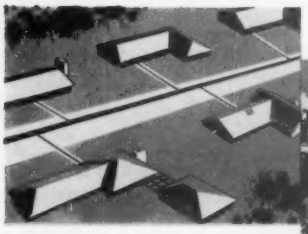
Men who know

quality specify . . .

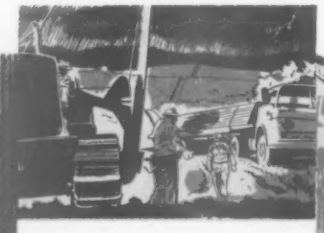
Southwestern Lightwall!

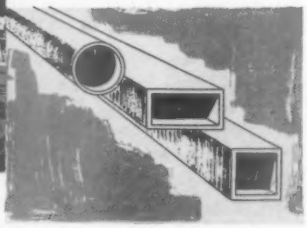
High strength . . . quality engineered Southwestern Lightwall saves important dollars when used in place of standard-weight pipe. At Southwestern, a continuous process of improvement upgrades pipe performance . . . in engineering, design, materials and manufacture. Average quality is not good enough—Southwestern demands the best, then finds ways to make that even better.

If profit and dependability are important . . . Specify Lightwall by Southwestern.


Southwestern Lightwall for mains and laterals in gas distribution systems to homes and industry.

Southwestern integral joint and non-upset E.R.W. oil country tubing for multiple completions and slim-hole drilling.


Southwestern Lightwall line pipe to keep oil and gas on the move in gathering lines—pipelines—waterflood projects.


Southwestern structural pipe and mechanical tubing for a thousand uses in industry, construction, furniture manufacture, fences, metal buildings. Round, rectangular, square and other shapes.

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P. O. BOX 2002 HOUSTON 1, TEXAS
PHONE CAPITOL 4-0631

SALES OFFICES IN MIDLAND, DALLAS, TULSA AND HOUSTON

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THE AMERICAN
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NOW!
Match bearings to engine for more drilling power

How long you maintain maximum power depends on the lubrication inside your engine, and it's the engine bearings that control this lubrication. To get lasting power from an overhaul, bearings must be matched to engine . . . matched with the right size *and the right bearing material.* And Federal-Mogul's full-range line gives you that bearing.

For example, bearings must have fatigue strength to stand up under the pounding of millions of shaft revolutions. Some new engines, however, have greatly increased bearing pressures and require a new kind of bearing. Federal-Mogul's answer is the overplated aluminum alloy bearing, one of those shown above. It can take loads of 6,000 pounds per square inch . . . three times the pressure of conventional babbitt bearings.

In addition to the overplated aluminum alloy bearing, the complete Federal-Mogul line includes 5-layer copper-alloy, straight copper-alloy, babbitt, and special-alloy bearings. This full-range line of bearings—in thousands of sizes—offers the replacement that exactly matches your engine. See your local Federal-Mogul jobber for fast delivery.

FEDERAL-MOGUL ENGINE BEARINGS

FEDERAL-MOGUL SERVICE

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 13, MICHIGAN

Better Production Tools Through Research

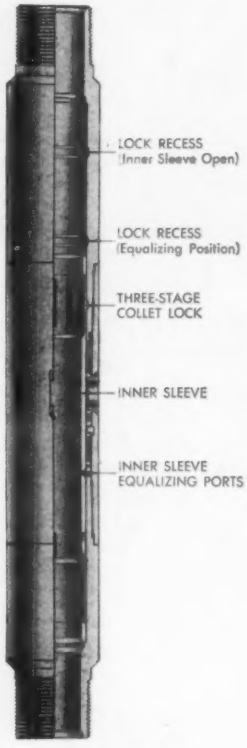
OTIS Equipment NEWS

Volume III, Number 1 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*

Otis Sliding Side-Door Proves Most Versatile Circulating and Production Tool in the Field Today

Three Different Versions Solve Many Costly Production Problems

DALLAS — The Type A Otis Sliding Side-Door®, designed and introduced to the oil industry just four years ago, has become the most widely used selective circulating and production tool in the field today. Since its introduction, two modified versions — the Sliding Side-Door, with pump-out plugs and expendable shifting device, and the Sliding Side-Door Cross-Over — have been introduced.



TYPE A OTIS
SLIDING SIDE DOOR

© 1961 O.E.C.

The Type A Otis Sliding Side-Door is a full-opening tool designed to provide a selective means of establishing a flow course between the tubing and annulus without killing the well, moving the tubing or disturbing the packer setting. The tool is so designed as to permit any number of Sliding Side-Doors to be installed in a single string of tubing and any one or all opened or closed by wire line methods using a standard Otis Shifting Tool. When desired, the Type A Sliding Side-Door may be equipped with a special expendable shifting device and run into the well on the tubing in the opened position. This expendable shifting device serves to catch an aluminum ball or drop plug which is pumped down after circulating to close the sleeve.

Proven Design Features

According to the many operators using this equipment, there is an exclusive combination of features that makes the Otis Sliding Side-Door preferable for efficient well completion and economical production. These are: (1) Thoroughly proven in hundreds of wells. The design and mechanical operation of the tool has several years of operating proof behind it — the producer can use the Otis Sliding Side-Door with confidence. (2) Provisions for a positive indication that the sleeve is fully shifted. The standard Otis Wire Line Shifting Tool used to shift the sleeve of the Sliding Side-Door is designed to release itself only after the sleeve has been shifted to its fully opened or fully closed position. Equalizing ports in the sleeve serve to permit equalization of abnormal pressure differential while shifting the sleeve. (3) Outer sleeve design and construction combined with the clearance between the inner and outer sleeves serve to eliminate the metal-to-metal bind that makes shifting other tools often impossible. The Type A Otis Sliding Side-Door is designed to withstand the distorting forces of temperature, compression, tension or torque and still be shifted. (4) The flow area of the ports in the sleeve has proved ample for most applications.

Versions for Special Application

A Type A Otis Sliding Side-Door with pump out plugs and an expendable shifting device is also available which has been designed to cut completion costs and provide additional blow-out protection in that it serves to permit high differential drillable packers to be tested and the tree nippled up before unloading the well.

Another version is the Otis Sliding Side-Door Cross-Over which is designed to provide for complete zone isolation while changing or removing cross-over chokes in single-string, dual completions.

All three Otis Sliding Side-Doors are available in a wide range of sizes — and all three Sliding Side-Doors are good examples of the cooperation of Otis' Well Completion Specialists and Engineering Staff in assisting operators to meet today's demand for economical well completion and production tools. Literally thousands of production problems have been solved by Otis over the past thirty years. Perhaps you are faced with a production problem Otis could help solve. If so, call your local Otis specialist today. For more information on Otis Sliding Side-Door equipment, call the Otis office nearest you or write Otis, Dept. E-1, P. O. Box 35206, Dallas 35, Texas. You'll find experienced Otis Well Completion Specialists ready to help you . . . anxious to serve you . . . and with the widest variety of field proven production equipment and services available today.

OTIS
Engineering Corporation
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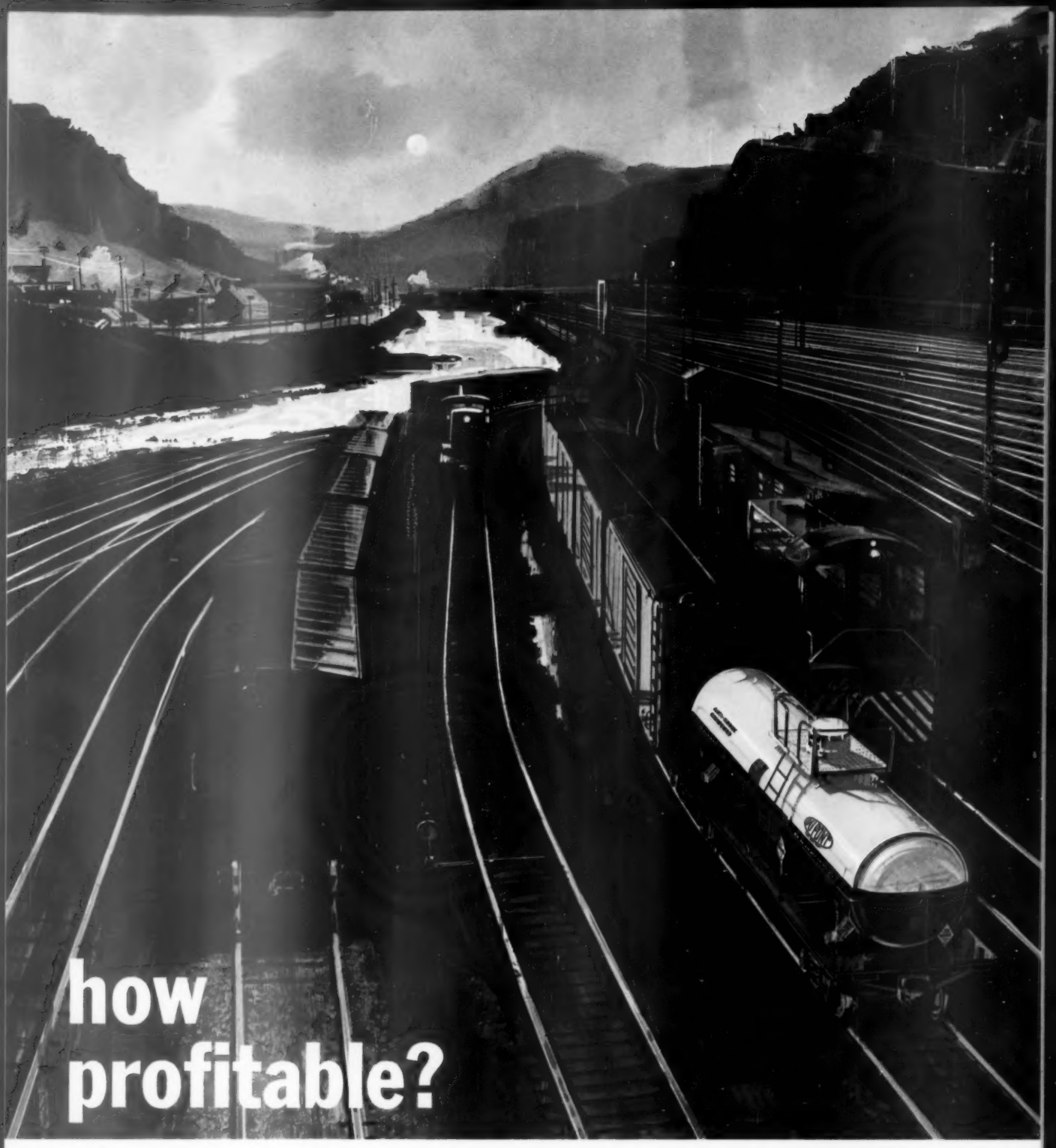
6812 Denton Drive • Dallas



With profits being squeezed, savings in refining costs, for example, are being actively pursued. That's why many oil companies are investigating TETRAMIX* antiknock compound — the new antiknock that, in many fuels, gives desired octane numbers at lower cost than is possible with TEL or TML. Helping you get such results is another practical advantage of doing business with DuPont.

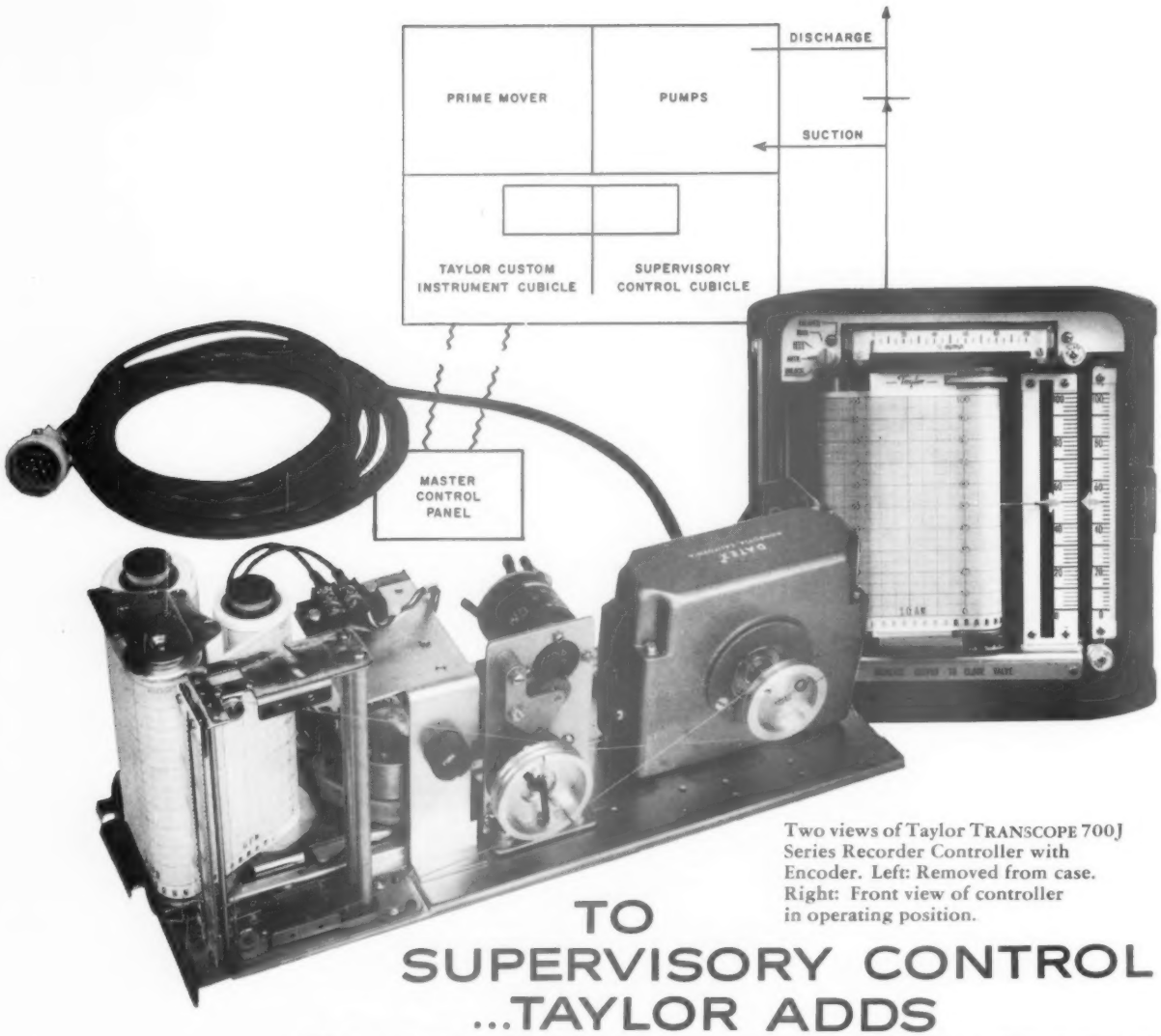
E. I. duPont de Nemours & Co. (Inc.), Petroleum Chemicals Division, Wilmington 98, Delaware.

*Trademark

LEAD ANTIKNOCK COMPOUNDS and other PETROLEUM ADDITIVES

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living ... *through Chemistry*



Two views of Taylor TRANSCOPE 700J Series Recorder Controller with Encoder. Left: Removed from case. Right: Front view of controller in operating position.

TO SUPERVISORY CONTROL ...TAYLOR ADDS SIMPLICITY!

Taylor local pump station control systems are designed for simplicity . . . and economy. One good example is the TRANSCOPE* 700J Series Recorder Controller with Encoder. The exclusive servo power feature not only assures more accurate records, but also permits integrally mounted encoders. This eliminates expensive high-speed analog-to-digital converters. Because each signal is individually transmitted, the source and location of any malfunction can be readily identified.

Another benefit of the Taylor system is the smooth over-ride its standard exclusive diode circuitry provides during transitions between suction and discharge control. The "reset windup" problem is eliminated.

Taylor Pipe Line Station Control Systems are daily proving themselves efficient and economical to leading pipe line companies throughout the country. Let Taylor's specialists study your problem. Whether it's a new installation or modernization, there's a Taylor electronic or pneumatic system to fit your needs.

Ask your Taylor Field Engineer about it or write to Taylor Instrument Companies, Rochester, New York, or Toronto, Ontario

*Trade Mark

Taylor Instruments **MEAN ACCURACY FIRST**

Bearing at left has 1.75" bore, while tandem bearing in main illustration has 17.0" bore. *Yet both are standard, cataloged items.*

Over 400 Cataloged Thrust Bearings
to fit your every need . . .

When you need a thrust bearing, no matter how special, Rollway is ready with the know-how and the precision machinery to design and produce it for you.

Our engineers will gladly consult with you regarding any standard or special-purpose types you need. No cost. No obligation. Rollway Bearing Co., Inc., Syracuse. N. Y.

Complete line of Radial and Thrust Cylindrical Roller Bearings

Select from 7
ROLLWAY
Standard Types

designed, tested and ready for production with load capacities to 4,800,000 pounds.

Ask for Catalog PT-659.

ROLLWAY®
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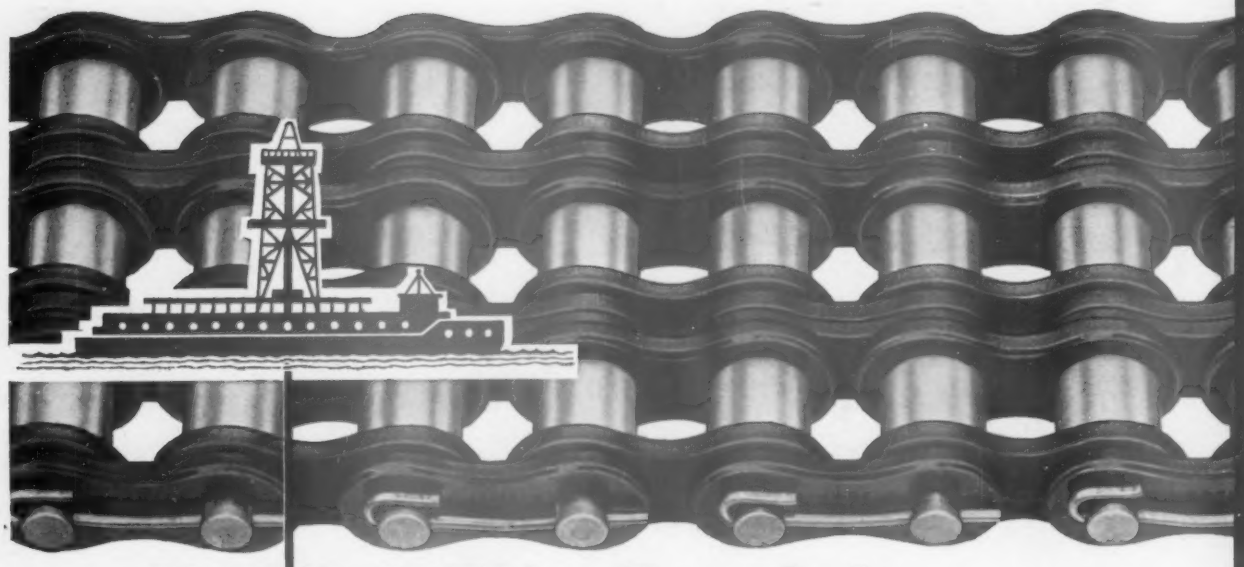
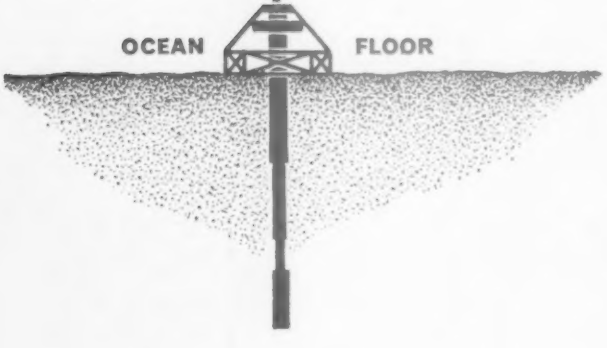


Link-Belt FR® roller chain delivered the power in historic deep-water probe

CUSS I, PROJECT Mohole's 3000 ton barge utilized four Diesel out-board engines to keep derrick in proper position over the hole, 2.3 miles below.



Several months ago, out in the Pacific, history was made. In 11,696 feet of turbulent sea, man probed closer to the earth's innards than ever before.

Link-Belt FR roller chain played a decisive role in this first phase of Project Mohole. It transmitted power to pumps and drawworks . . . helped control a quarter of a million pounds of drill string stretching down through unpredictable ocean currents.

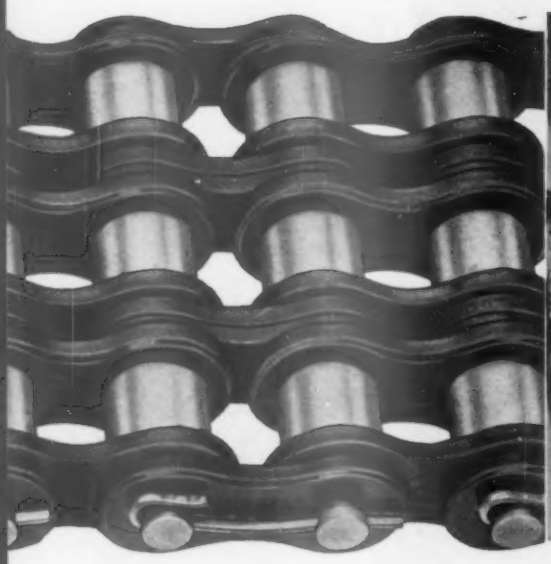
The unusual drive arrangement shown in illustration at right requires roller chain with capacity to withstand smashing impacts and tortuous stresses met in day to day drilling. The exceptional endurance required of equipment owned and operated by Global Marine Exploration Company is just another reason why Link-Belt FR roller chain has been the choice of rig manufacturers for many years.

For full data on the chain that assures *more on-bottom time*, ask any leading supply store for our Catalog 2980. And for engineering assistance in applying FR roller chain, write Link-Belt Company, Indianapolis 6.

LINK-BELT

ROLLER CHAINS AND SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 6, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 15,743



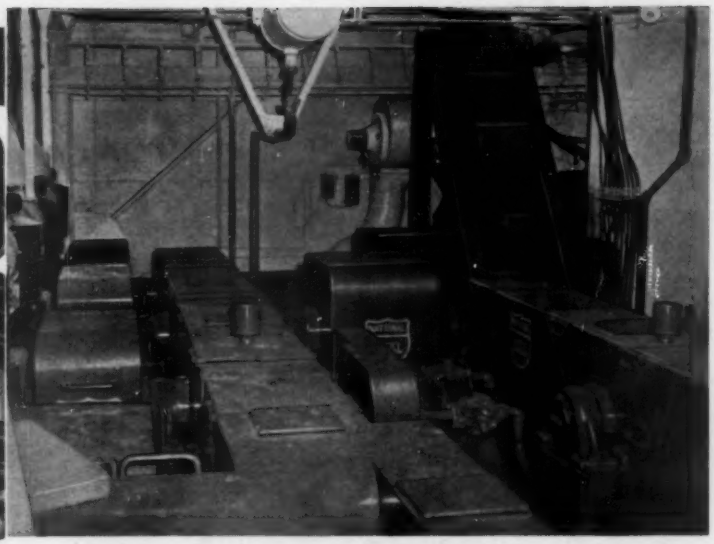
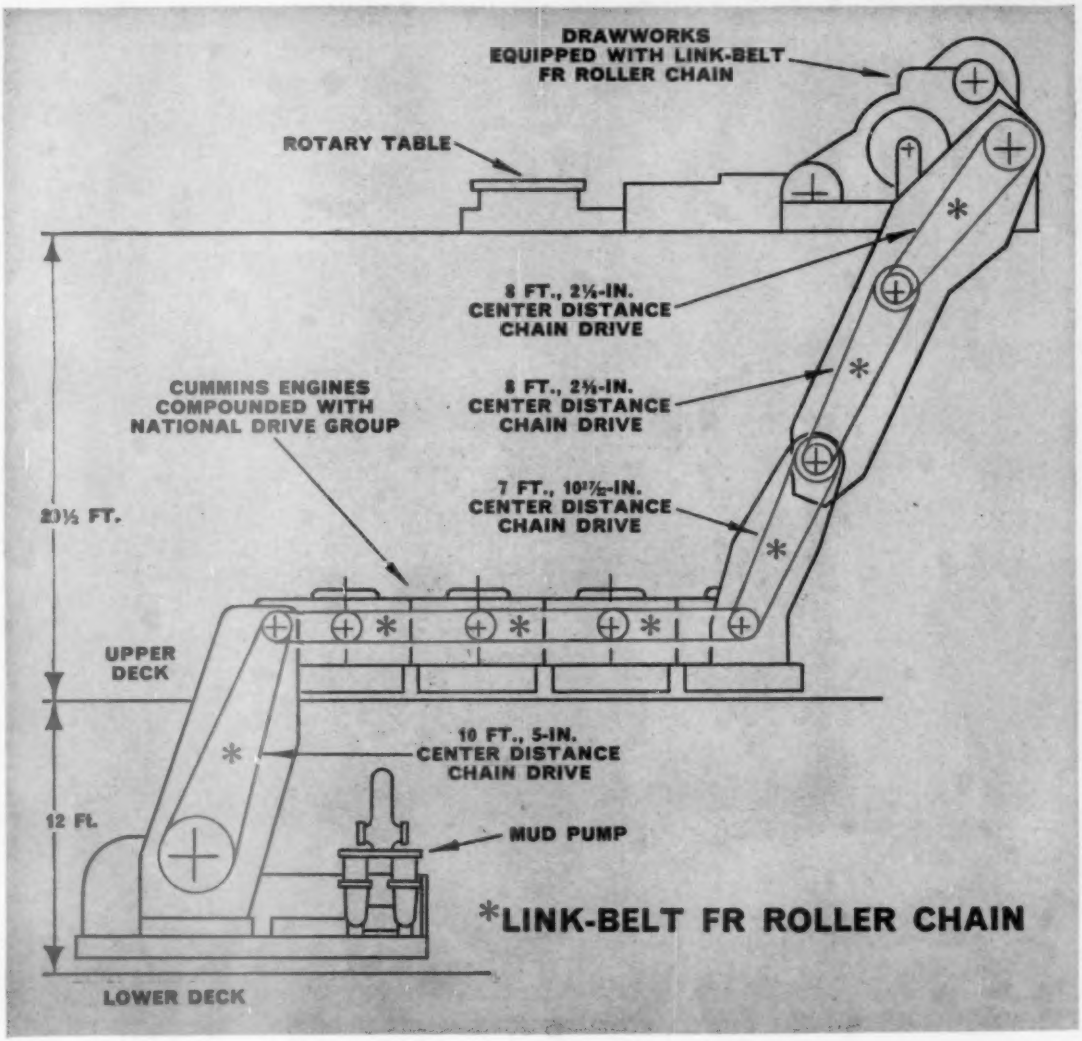
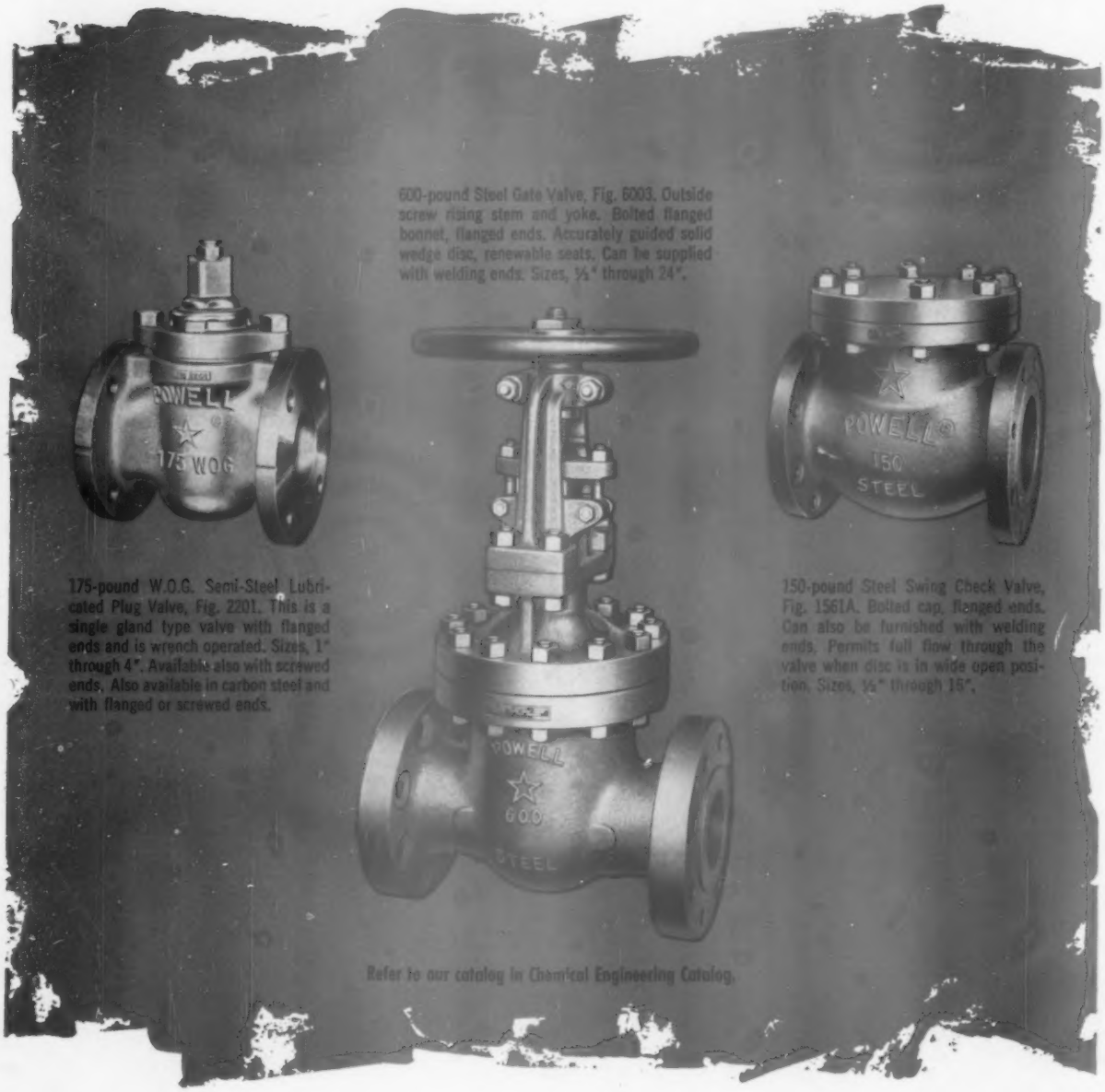


PHOTO OF NATIONAL SUPPLY DRIVE GROUP for compounding the power of Cummins engines required for operation of drawworks and mud pumps.



SAVE...SPECIFY POWELL VALVES

You can count on Powell—the world's largest family of valves. Powell valves are stocked across the nation, specifically for the oil industry's needs. This means fast delivery, less down time. In short, important savings for you.
In operation, you'll find Powell valves produce big savings in maintenance because every Powell valve is the product of engineering skill and exhaustive testing that results in one thing—trouble-free service. So, specify Powell valves from your distributor, or write The Wm. Powell Company, Cincinnati 22, Ohio, for valves you can count on.



600-pound Steel Gate Valve, Fig. 6003. Outside screw rising stem and yoke. Bolted flanged bonnet, flanged ends. Accurately guided solid wedge disc, renewable seats. Can be supplied with welding ends. Sizes, ½" through 24".

175-pound W.O.G. Semi-Steel Lubricated Plug Valve, Fig. 2201. This is a single gland type valve with flanged ends and is wrench operated. Sizes, 1" through 4". Available also with screwed ends. Also available in carbon steel and with flanged or screwed ends.

150-pound Steel Swing Check Valve, Fig. 1561A. Bolted cap, flanged ends. Can also be furnished with welding ends. Permits full flow through the valve when disc is in wide open position. Sizes, ½" through 16".

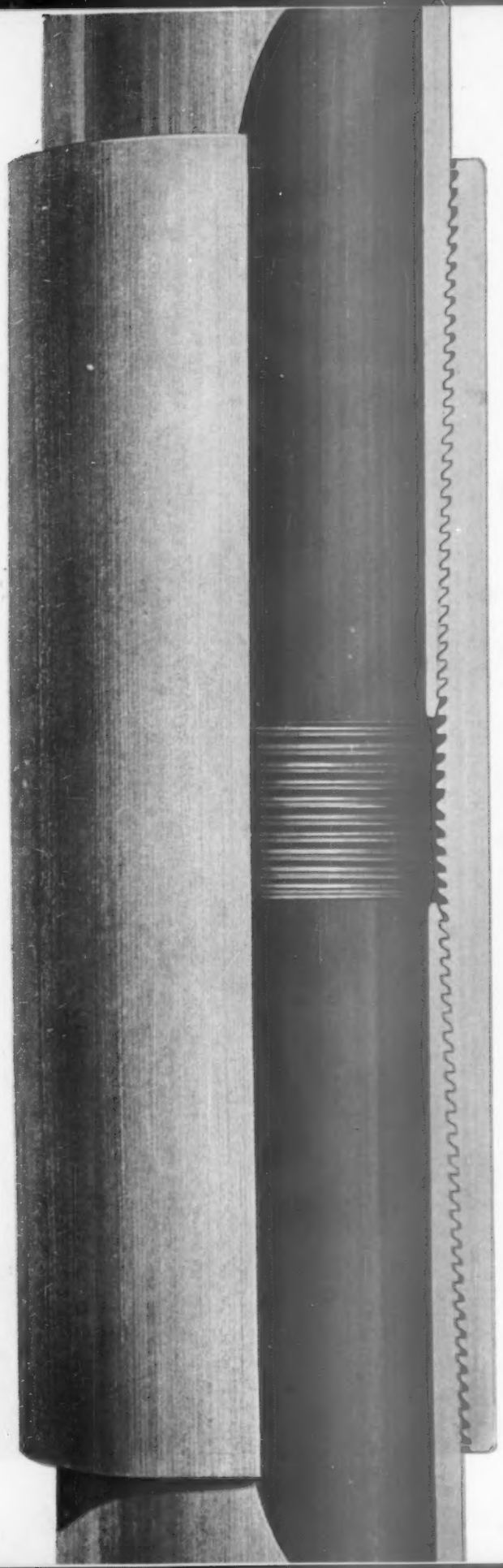
Refer to our catalog in Chemical Engineering Catalog.

115th year of manufacturing industrial valves for the free world

POWELL PETROLEUM VALVES

THE WM. POWELL COMPANY CINCINNATI 22, OHIO

This advanced thread design cuts pipe costs...



Until recently, oil country casing and tubing had utilized upset ends to strengthen the joint for deeper wells. But this joint thickening meant a loss of valuable space within the casing—space that's more important than ever with the trend toward more multiple completion wells and slim hole wells.

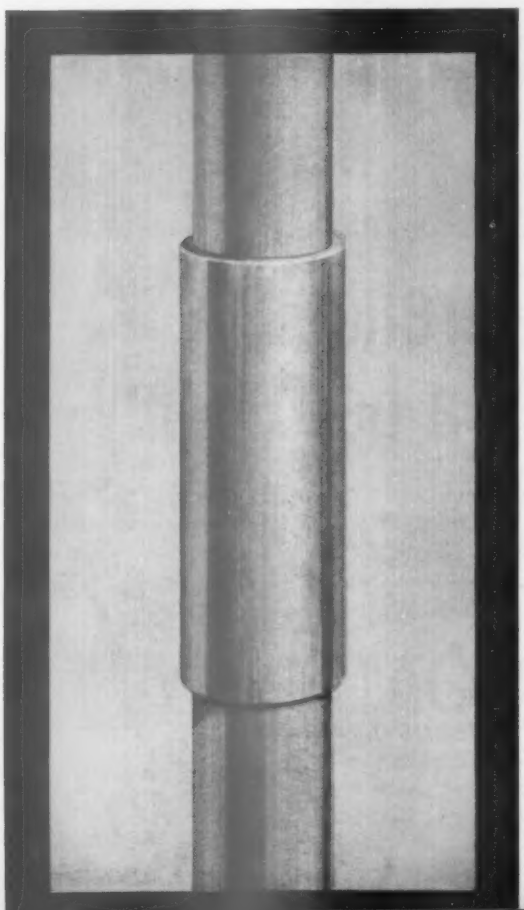
National Tube has developed a non-upset joint—the cost-saving USS National Buttress-Thread joint. The unique run-out design and flank angle of the Buttress-Thread gives pipe all the strength it needs. In fact, the joint strength is comparable to that of the body of the pipe. The Buttress-Thread eliminates the need for the internal upset in casing, as well as the external upset in tubing. Now there's maximum hole clearance, and multiple tubing strings can be run with minimum interference.

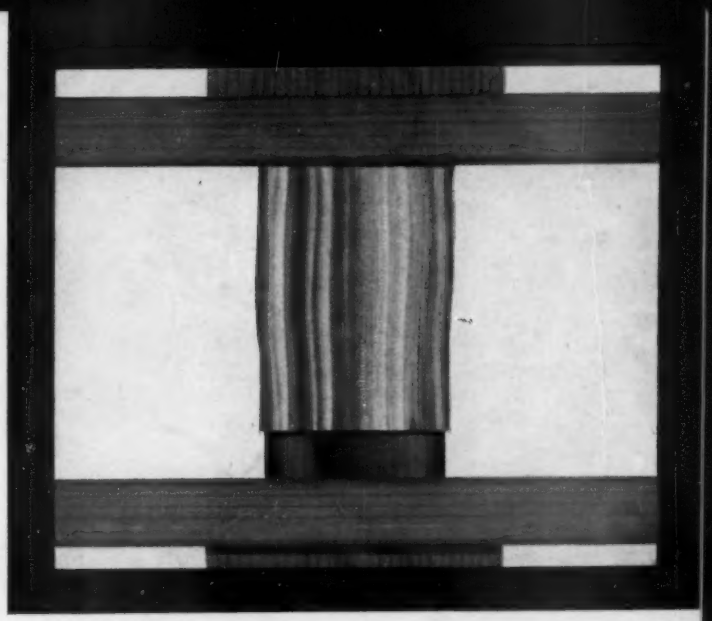
To prove the exceptional strength of the Buttress-Thread casing joint, National Tube engineers drove pipe nipples into the coupling until the threads tore loose. Despite this brutal pounding, the coupling did not

fail—the joint remained intact.

The latest adaptation of the Buttress-Thread is to oil well tubing. USS National Buttress-Thread tubing can be readily stabbed firmly into a coupling without thread damage or cross threading. Mill tests show joints can be made up and broken at least 12 times without thread damage or impairment to joint performance. Make-up time is faster because the pipe slips easily into the coupling, and engages immediately. Then 2½ turns make the joint gas-tight.

The coupling threads are





heavily tin-plated so gas won't leak even at pressures of 15,000 psi. You get more use out of Buttress-Thread tubing because, unlike upset pipe, if ends are damaged, they can be repaired by cutting new threads right in the field. For more information on casing or tubing with the Buttress-Thread, call or write National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Penna.

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National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
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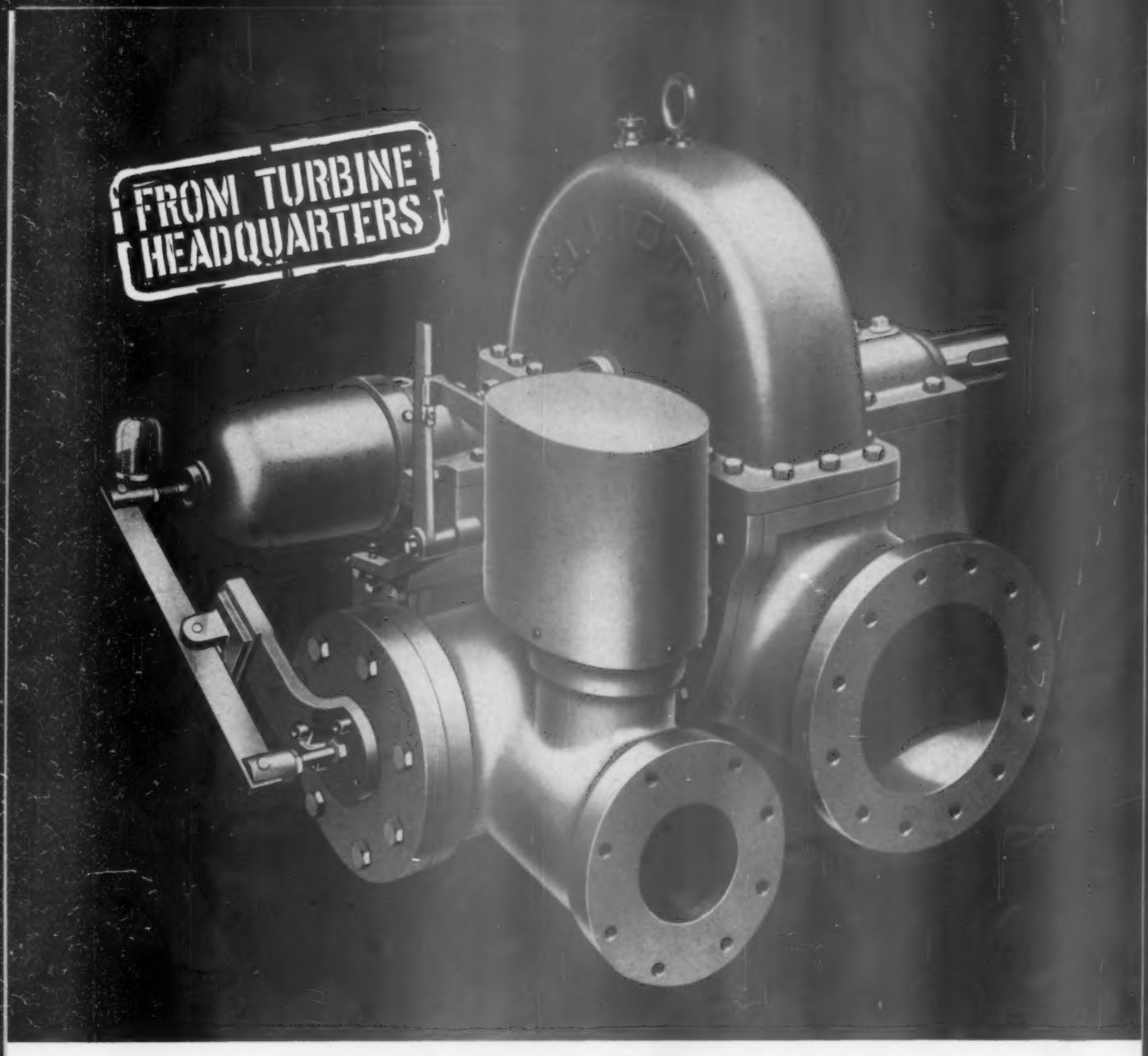
This mark tells you a product is made of modern, dependable Steel.



Six marked differences make Elliott turbines a better buy

Why are Elliott YR turbines your best choice for mechanical drives? Some of the reasons are described on the opposite page. These are tangible reasons why you can expect dependable, economical operation with little care or attention.

With more than 50 years' experience in mechanical-drive turbines up to 50,000 hp; with the most complete line of field-proven machines; with engineering and service facilities nationwide: Elliott is clearly "Turbine Headquarters." Write for bulletin H22-D.

TURBINES FOR DEPENDABLE day-in/day-out SERVICE

ELLIOTT COMPANY

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PLANTS AT: Jeannette and Ridgway, Pa.; Springfield, Ohio
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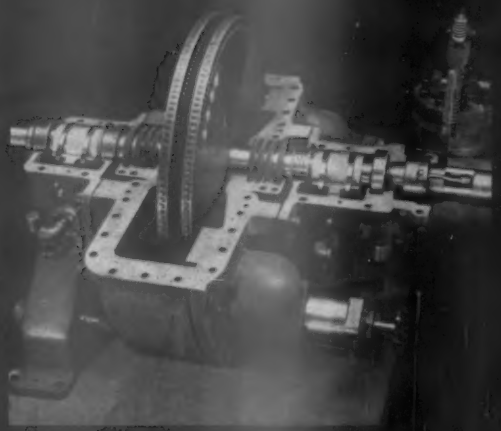
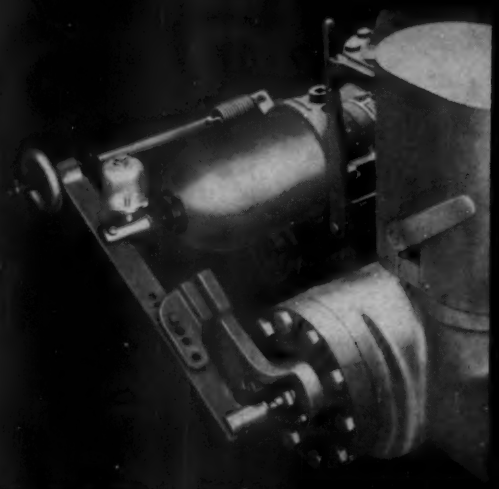
H1-1



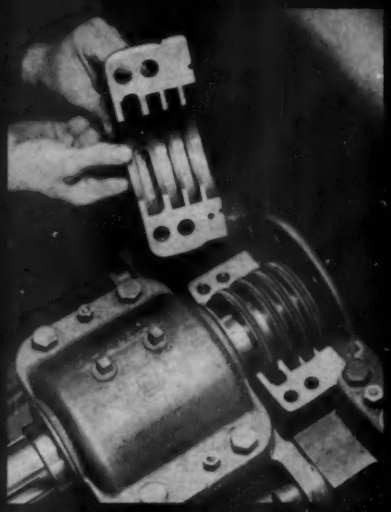
Precise alignment of shaft, through true centerline support, permits smooth and dependable operation at all operating temperatures.



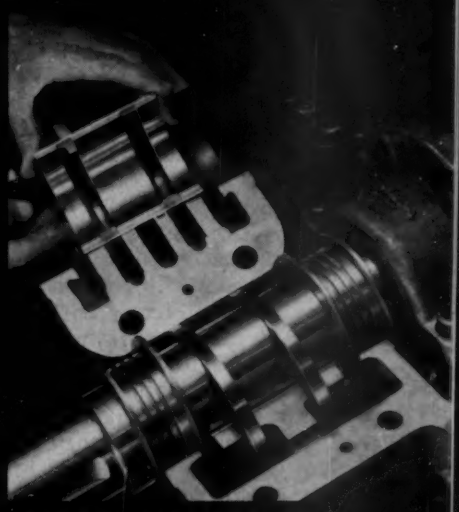
Simple, positive direct-acting speed governing system is dependable, weather-proof, accurate. Separate trip gives positive overspeed protection.

These features mean dependable, economical turbine operation:

1. True centerline support
2. Positive speed control
3. Accessible shaft seals
4. Inexpensive bearings
5. Optional hand valve
6. Full protection

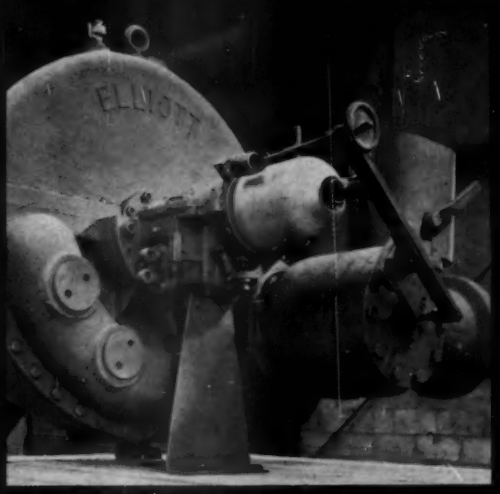


Accessible shaft seals simplify maintenance and routine inspection. Covers readily removed without disturbing casing.



Inexpensive liner-type bearings readily installed with no scraping, fitting or adjustment required.

Steam-saving hand valve with pilot, which can be opened against full steam pressure, reduces steam consumption at partial loads.



All-weather protection is standard for Elliott YR turbines. They shrug off heat, snow, moisture, dust or contaminated atmosphere.

THEY SAY

Friendly name for gas line

Dear Sir:

Why not suggest to our good friends in Houston and Mexico that they name the new pipeline (OGJ, Sept. 18, Journally Speaking, p. 53) the "Neighbor Line," the FPC and California politicians permitting.

Frank A. Morgan
Consultant
Los Angeles

Lots of mapping left to do

Dear Sir:

In the September 18 issue of the Journal (p. 155) Frank Gardner has put together an excellent write-up on the massive job of geological mapping of the entire State of Kentucky, which has just begun.

The article rightly holds up Kentucky for praise at being one of only 13 states that have had detailed topographic quadrangle maps made of the whole state.

This is an enviable record for these 13, and should cause many of us other states, which have topographic maps of only 25% of our areas or less, to strive manfully to emulate her. In fact, most of us are making strides in this direction with our own co-op topographic projects.

In addition, the article places most stress on the geological mapping of the total state, which like the topographic mapping, is being done cooperatively by the USGS and the state geological survey on a 50-50 basis. Truly this is a pioneer project of its type, and is to be commended.

The great efforts of Dr. Wallace W. Hagen, Kentucky state geologist, in helping to obtain the state's share of the funds for this work, and in maintaining the responsibility for following through on the state's side of this effort, went unheralded, though.

The theme of the whole article—that only a relatively small part of the United States has been geologically mapped to date, after 75 years, and that we must do better—is graphically stated and is only too true.

However, it is most unfortunate that the article did not point out the large amount of detailed geologi-

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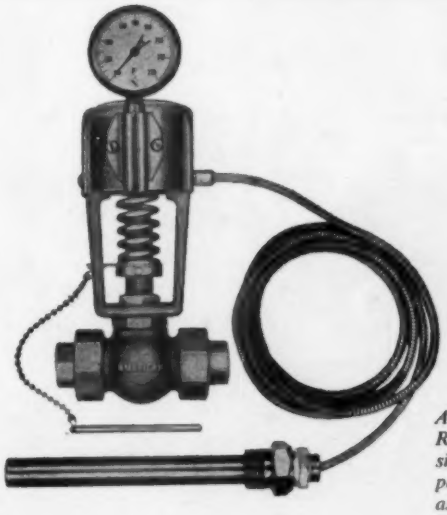

American Temperature Regulators are made in sizes ½" to 4". Temperature ranges as low as minus 15° F. to 50° F.—as high as 240° F. to 350° F.

response

You get fastest possible temperature response from these new regulators because the stem cannot bind and retard valve action.

The valve stem on American Temperature Regulators is sealed off by a friction-free bellows that makes practical a nonleaking packless valve. Also contributing to fast, stable action is the use of an extra-long preflexed adjusting spring. This spring permits a long range of temperature adjustment without disturbing valve sensitivity at normal levels.

There are other high-quality features in American Temperature Regulators: maximum use of stainless steel; standardized parts; the fewest possible components; and unitized assembly. In addition, compactness simplifies installation in "tight" locations.

Accurate temperature regulation and attention-free operation mean long-term economy. Your industrial supply distributor will gladly help you select the right American Temperature Regulators for your needs. Write for Bulletin 114A.

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Take a tip from this contractor...

TRADE UP AND MAKE MORE PROFIT

New D6B Tractors do work 30% faster— cut fuel costs for Carl Rumage

Working in rain, this new D6B Tractor digs a salt water pit 40 ft. x 75 ft. x 10 ft. In spite of slippery ground and exceptionally tough, sticky soil, the tractor will finish the job in a single day. Mr. Rumage keeps his equipment moving — handles soil conservation work when not busy in the oil fields.

Like most contractors today, Carl Rumage, owner of C. A. Rumage Co., Vernon, Texas, is fighting the squeeze on profits every way he can. He's found one of the best ways is to trade up for new, more productive machines—even if existing equipment is working fine. Two new D6B Tractors, recently purchased by this contractor, provide a good example.

Comparing the new D6 with the old D6, Carl Rumage says, "Our new machines do the work at least 30% faster . . . and they do it on less fuel! Trading up to the new D6 is sure paying off for us."

There's good reason for Mr. Rumage's enthusiasm. The new 93 HP Cat D333 Diesel Engine, for example, has 25% more lugging ability than the previous model. A more comfortable operator's compartment and convenient controls help keep operator efficiency high. A new hydraulic bulldozer, with quick-drop valves, gives faster operation, increased productivity.

The new D6B helps keep down operating costs in several ways. Its easy-breathing Cat Engine can operate on high-energy, low-cost fuels such as No. 2 furnace oil. It has a dry-type air cleaner that eliminates the expense and bother of handling filter oil, can be serviced in five minutes, and keeps 99.8% of air-borne dirt out of the engine.

The long-life Caterpillar oil clutch usually gives up to 2000 hours of service before it even needs adjustment. Lifetime lubricated rollers that never need attention until rebuild time are a real convenience and save in maintenance costs.

Trading up to new, more productive D6B Tractors certainly made sense for Carl Rumage. A similar trade may help solve your profit problem. Your Caterpillar Dealer can help you decide and can demonstrate the production advantages of new Cat-built machines. See him today.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

BETTER MACHINES MEAN BETTER PROFITS

cal mapping of quadrangles that has been done by many state geological surveys within their respective borders.

There is a lot of geology yet to be mapped, not only as quadrangles but also as areas of other dimensions. This can be done by state geological surveys, by the USGS, and under some circumstances by both, cooperatively.

Allen F. Agnew
State Geologist
South Dakota

Careless governor?

Dear sir:

The editorial "Gasoline tax bucks diminishing returns" in the September 18 issue of The Oil and Gas Journal (p. 55) points up a very serious situation that we are facing here in Pennsylvania.

It does not, however, come up with a very satisfactory cure or spell out the basic cause of the trouble, namely, that the Pennsylvania state administration does not concern itself with the welfare of the small retail merchant and business man.

Since Pennsylvania raised its gasoline tax 40%—from 5 to 7 cents a gallon—the 2% decline in the sales volume of gasoline which is recorded will still result in a 37% increase in tax revenue to the Highway Department. So why should Governor Lawrence interest himself in this drop in volume?

As a matter of fact, all during the legislative discussions of this tax increase, the Lawrence administration showed no concern whatsoever with the probable loss of business that the gasoline retailers would sustain. This, they said, was pure imagination and would not occur. The entire emphasis was on the desirability of the extra tax for road construction and no consideration was shown for the effect on business.

You can be sure that everyone connected with the petroleum industry in Pennsylvania is mighty worried about this development and with the law of diminishing returns. As for our governor, apparently he just does not care.

F. B. Hufnagel, Jr.
Philadelphia.

That insidious device

"No other industry virtually guarantees its distribution and retailing segment a profit, or even assures its continued existence. If it can't cut the mustard with the public, it fails.

"So, it may be that we suppliers, in our frantic anxiety to fight off competition, have naively adopted that insidious device known as the subsidy, or guaranteed margin. Perhaps at one time, judiciously and sparingly used, it was an asset—perhaps a necessity. Today, its widespread use as a retaliatory measure has certainly contributed towards perpetuation of price wars, and probably has instigated most.

"Most important—and here is the key issue—I believe that its continued application in the market place prohibits sensible settlement of the very differentials being questioned.

"And, with major and independent brands both seeking that solution in the market place, the question may well be: How much longer can we expect the Government to refrain from settling our problems for us?"

R. L. Berry, general manager, marketing division, Delhi-Taylor

"Triple Threat"
TO SUCKER ROD FATIGUE
1. JONES SUCKER RODS
2. JONES UNDERCUT PINS
3. JONES ROLLED THREADS
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Rolled threads are stronger at the point where most pin failures originate . . . steel fibers and grain are rearranged to follow the thread contour, providing a dense structure at the critical thread root. Sucker rods with rolled threads make up tighter and stay tight because there are no high spots to beat down and cause the joint to loosen.
Undercutting the pin shank further increases fatigue resistance by eliminating the run-out thread and improving the elasticity of the joint.
Ask your Jones representative for further information on the "Triple Threat".
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SUCKER RODS

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LITE-WATE

A Complete Low Density Cement that is

HIGHLY IMPERMEABLE

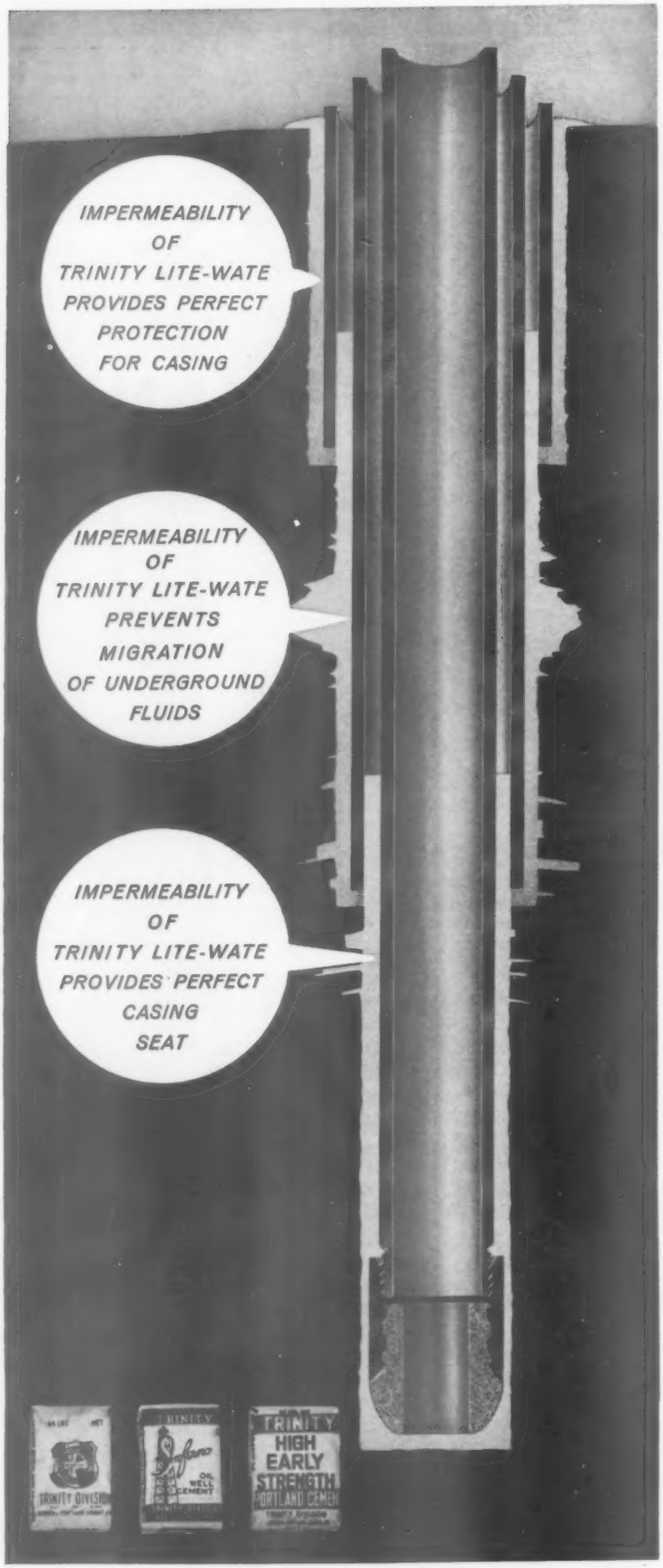
Trinity Lite-Wate fulfills all important functions when placed in an oil or gas well.

PERMEABILITY TEST DATA

All slurries were prepared according to procedures of API RP 10B and cured at 140°F and atmospheric pressure for 72 hours.

Percent Mixing Water	Slurry Wt. Pounds Per Gallon	Permeability Millidarcys*
65	13.66	0.001
75	13.18	0.001
85	12.77	0.001
95	12.44	0.001
105	12.14	0.002
115	11.89	0.003

*A darcy is that measurement of permeability that will permit a liquid having a viscosity of one centipoise to flow at the rate of one milliliter per second through a specimen one centimeter in length and having a cross section of one square centimeter under a pressure difference of one atmosphere. A millidarcy is 0.001 darcy. The permeability of Trinity Lite-Wate cement is expressed in millidarcys.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IMPERMEABILITY OF TRINITY LITE-WATE PREVENTS MIGRATION OF UNDERGROUND FLUIDS
IMPERMEABILITY OF TRINITY LITE-WATE PROVIDES PERFECT CASING SEAT
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TRINITY
HIGH EARLY STRENGTH PORTLAND CEMENT

TRINITY

PORTLAND CEMENT DIVISION
GENERAL PORTLAND CEMENT COMPANY

DALLAS·FT.WORTH·HOUSTON

Oil Corp., in a speech to the Empire State Petroleum Association.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

OCTOBER

15-17 National Association of Oil Equipment Jobbers, annual convention and trade show, Mayflower Hotel, Washington.
15-18 American Petroleum Credit Association, annual conference, Shamrock-Hilton Hotel, Houston.
17 National Oil Fuel Institute, first annual meeting, Waldorf-Astoria, New York.
17-19 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Morrison Hotel, Chicago.
18-20 Rocky Mountain Oil and Gas Association, annual convention, Denver-Hilton Hotel, Denver.
18-21 American Association of Petroleum Geologists, Mid-Continent regional meeting, Amarillo, Tex.
19 West Central Texas Oil and Gas Association, annual meeting, Hotel Windsor, Abilene, Tex.
19-20 National Conference on Industrial Hydraulics, sponsored by Illinois Institute of Technology and engineering societies, Sherman Hotel, Chicago.
19-21 National Society of Professional Engineers, fall meeting, Hotel Roanoke, Roanoke, Va.
19-22 Louisiana Gulf Coast Oil Exposition, Lafayette, La.
20 American Institute of Chemical Engineers, South Texas section, annual technical meeting, Moody Civic Center, Galveston, Tex.
23-25 Pennsylvania Grade Crude Oil Association and Pennsylvania State University Mineral Industries Experiment Station, technical conference on oil recovery by solvents, Pennsylvania State University campus, University Park.
24-25 University of Kansas, Southwest Kansas Center, sixth annual natural-gas pipeline institute, Court House, Liberal, Kans.
24-27 National Association of Corrosion Engineers, south-central region conference and exhibition, Shamrock-Hilton Hotel, Houston.
25-26 National Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.
25-27 Gulf Coast Association of Geological Societies, annual meeting, Granada Hotel, San Antonio, Tex.
27 Natural Gas Processors Association, southern regional meeting, Carlton Hotel, Tyler, Tex.
27 Permian Basin Petroleum Pioneers Day, Midland, Tex.
29-31 Independent Petroleum Association of America, annual meeting, Shamrock-Hilton Hotel, Houston.
29-Nov. 1 National Lubricating Grease Institute, annual meeting, Rice Hotel, Houston.
29-Nov. 10 Northwestern University, Transportation Center, executive seminar on transport costs, prices, and profits, Evanston, Ill.

NOVEMBER

1-3 Southwest Federation of Geological Societies, annual meeting, Hilton Hotel, El Paso, Tex.
2-3 Society of Petroleum Engineers of AIME, annual California regional meeting, Hacienda Motel, Bakersfield, Calif.
2-3 API, annual agriculture-petroleum seminar, Louisiana State University, Baton Rouge.
2-3 Southern Gas Association, research and development roundtable conference, Shreveporter Highway Hotel, Shreveport, La.
2-4 Geological Society of America, annual meeting, Cincinnati, Ohio.
5-9 Society of Exploration Geophysicists, international meeting, Denver.
6-8 Chemical Institute of Canada, conference of the chemical engineering division, Royal York Hotel, Toronto.
9-10 Society of Automotive Engineers, national fuels and lubricants meeting, Shamrock-Hilton Hotel, Houston.
13-15 American Petroleum Institute, forty-first annual meeting, Conrad Hilton, Congress and Palmer House hotels, Chicago.
16 Illinois Oil and Gas Association, annual meeting, Mount Vernon, Ill.
17 Natural Gas Processors Association, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.
26-Dec. 1 American Society of Mechanical Engineers, winter annual meeting, Statler-Hilton Hotel, New York City.

DECEMBER

3-6 American Institute of Chemical En-

NEW

FROM MERLA

WFM-12R

GAS LIFT VALVE WITH ½" MAIN PORT

For KB and KC Mandrels!

Merla's WFM-12R is the first and only pilot-operated gas lift valve with ½" main port for the KB and KC series mandrels!

The wire-line retrievable WFM-12R has passed the toughest test of all: Right now in Mississippi this great new valve is simultaneously producing heavy salt water from a 12,000 foot dual installation.

For more information about the WFM-12R, write for bulletin 961.

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gineers, annual meeting, New Yorker Hotel, New York City.

4 AIME's Society of Petroleum Engineers, Arizona section, annual meeting, Pioneer Hotel, Tucson.

4-6 Interstate Oil Compact Commission, annual meeting, Denver Hilton Hotel, Denver.

5-6 National Petroleum Refiners, Association, computer conference for refiners, Hotel Tulsa, Tulsa.

JANUARY

7-10 Pipe Line Contractors Association, annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

8-12 Society of Automotive Engineers, annual meeting, Cobo Hall, Detroit.

16-18 Kentucky Petroleum Marketers Association, annual meeting and convention, Brown Hotel, Louisville, Ky.

19 Natural Gas Processors Association, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

FEBRUARY

4-7 American Institute of Chemical Engineers, national meeting, Statler Hotel, Los Angeles.

14-17 Pipe Line Contractors Association of Canada, Castle Harbor Hotel, Bermuda.

15-17 Southwestern Legal Foundation, annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.

18-22 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, New York City.

27-Mar. 2 International Oil and Gas Educational Center, institute on economics of the gas industry, Southwestern Legal Center, Dallas.

MARCH

2 Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus, Ohio.

4-8 American Society of Mechanical Engineers, gas turbine-process industries conference, Shamrock Hilton Hotel, Houston.

16 Natural Gas Processors Association, Oklahoma regional meeting, Sheraton-Oklahoma Hotel, Oklahoma City.

18-22 National Association of Corrosion Engineers, meeting, Municipal Auditorium, Kansas City, Mo.

19-22 Kentucky Petroleum Marketers Association, management institute conducted by the University of Louisville, Brown Hotel, Louisville, Ky.

21-23 New England Gas Association, annual meeting, Statler-Hilton Hotel, Boston.

21-23 American Petroleum Institute, Division of Production, southwestern district meeting, Lincoln Hotel, Odessa, Tex.

26-29 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, joint annual meeting, Fairmont Hotel, Civic Auditorium, San Francisco.

APRIL

3 Chemical Institute of Canada, chemical economics division conference, Royal York Hotel, Toronto.

4-6 API, Division of Production, Mid-Continent district meeting, Sheraton Oklahoma Hotel, Oklahoma City.

9-10 Instrument Society of America, national chemical and petroleum instrumentation symposium, Wilmington, Del.

9-12 National Oil Fuel Institute, national oil heat and air conditioning exposition, Chicago.

11-12 Petroleum Industry Electrical Association and Petroleum Electric Supply Association, convention and exposition, Dallas.

11-13 API, Division of Production, Rocky Mountain district meeting, Hilton Hotel, Denver.

14-18 Petroleum Equipment Suppliers Association, annual meeting, Boca Raton Hotel, Boca Raton, Fla.

15-18 American Society of Mechanical Engineers, oil and gas power division conference, Shoreham Hotel, Washington.

17 Society of Plastics Engineers, Philadelphia section, regional technical conference, Sheraton Hotel, Philadelphia.

17-19 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.

17-19 American Society for Metals, regional conference and exhibition, materials and materials processing for the petroleum, petrochemical and chemical industries, Shamrock-Hilton Hotel, Houston.

23-25 American Association of Petroleum Geologists, Rocky Mountain section annual meeting, Salt Lake City.

25-27 Natural Gas Processors Association annual convention, Hilton Hotel, Denver.

29-May 1 Independent Petroleum Association of America, midyear meeting, Hotel Muehlebach, Kansas City.

29-May 2 Liquefied Petroleum Gas Association, annual convention and trade show, Conrad Hilton Hotel, Chicago.

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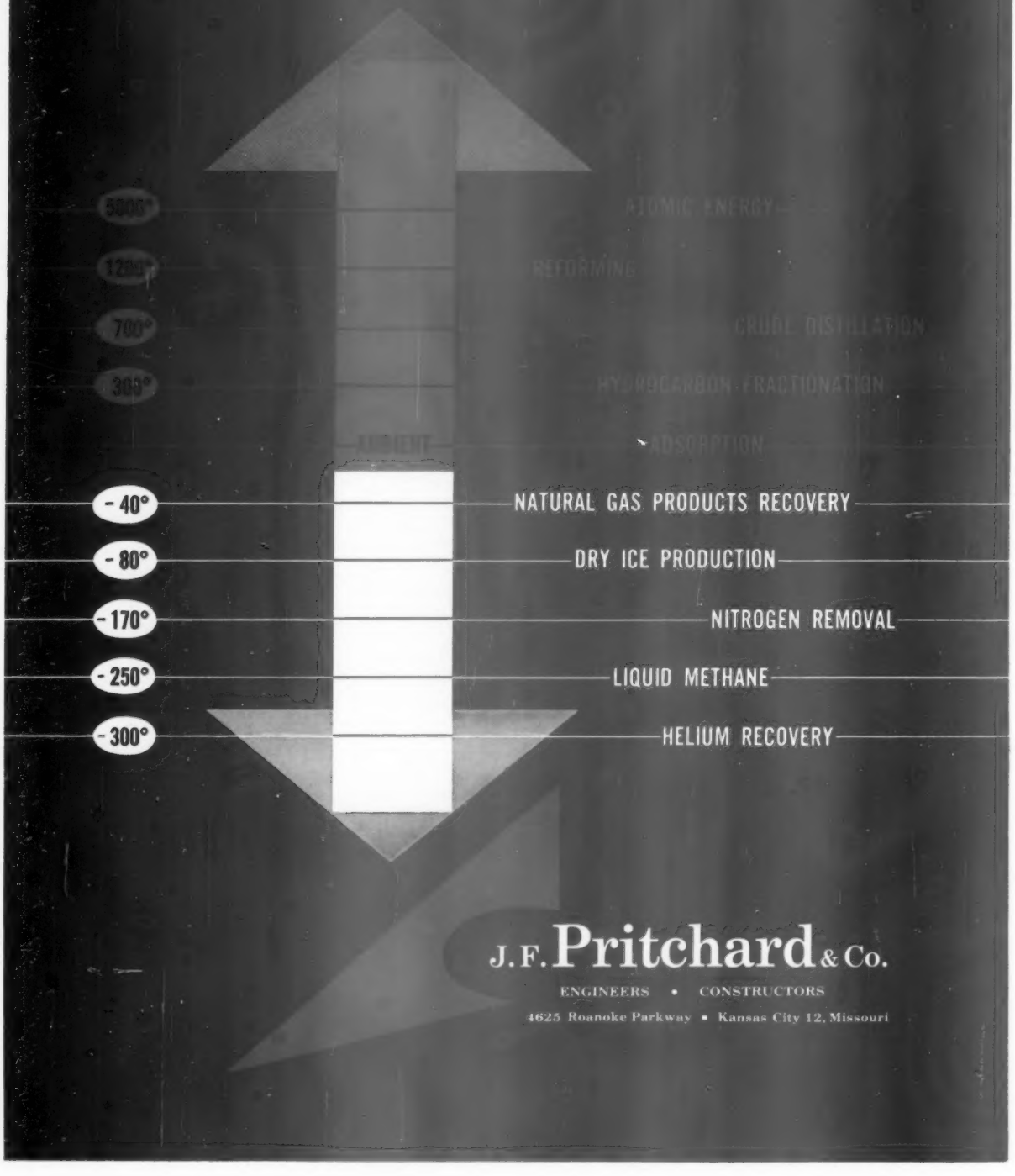

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THE JOURNAL SAID

50 years ago

October 19, 1911

Standard Oil Co. inaugurates a system of river transportation of refined oils. Its initial shipment of 325,000 gal. has been loaded out of its refinery at Wood River, Ill., and is moving down the Mississippi River destined for Louisville, Ky. A newly completed steel barge with a capacity of 500,000 gal. is being used. Plans call for a round trip every 10 days. Outcome of the experimental operation is being watched with interest.

Elaborate signs and decorations adorned the first tank-car shipment of oil moved out of Ponca City, Okla., this week. Signs identified the shipment as being from the property of 101 Ranch Oil Co., owned by the famous Miller Brothers.

Regal Oil & Gas Co. acquires Charles Page's Taneha, Okla., oil properties for a price variously estimated from $800,000 to $1,000,000. Regal, owned by eastern interests, plans to build a refinery at Sand Springs.

25 years ago

October 15, 1936

Emergency conservation measures adopted in the booming Rodessa field of northwestern Louisiana and northeastern Texas cut the daily waste of flared natural gas from more than 600 M.M.c.f. to less than 300 M.M.c.f. The new order limits producing gas-oil ratios to 12,500 cu. ft. per bbl. for oil wells, and 25,000 cu. ft. per bbl. for condensate wells.

Oil Terminals, Inc., acquires properties formerly operated by Western Oil & Refining Co. in the Wilmington area of California. Involved is a 10,000-bbl. refinery, wharf and landing facilities, and pipelines with a main line from Signal Hill field.

10 years ago

October 18, 1951

Completion of an agreement to start water-flooding operations in the Naval Reserve field, in Osage County, Oklahoma, assures a third crop of oil from its old field. Waterflooding will replace a gas-injection program now nearing its end. The Texas Co. (Texas Inc.) will operate the flood for 13 member-operators forming the Naval Reserve unit.

Phillips Petroleum Co. wins 1951 Award for Chemical Engineering Achievement for its work in the commercial development of high-abrasion carbon black and cold rubber.

JOURNALLY SPEAKING

Lucky gas users

THE NATION'S gas consumers are an extremely fortunate group. No other group of consumers is favored with anything like the same sort of governmental machinery for keeping down prices of commodities they may want to purchase.

Gas consumers have a unique opportunity to use state and federal regulatory powers to hold down the production and raw-material prices of their commodity at its source. There is nothing else like it anywhere this side of the Iron Curtain.

Take electricity, for example. It is regulated as a public utility, but we never heard of a state public-utility commission putting pressure on a federal regulatory agency to prevent an electric company in another state from building a new generating plant on the theory that the new electricity might cost more and raise the national average level of prices.

Yet some state PUC's force the Federal Power Commission to challenge the judgment of transmission companies in contracting for new gas supplies at prices higher than they used to pay years ago—even though none of the new gas is slated to go to the consumers in whose name the protests are filed. The theory is that if nobody is allowed to pay a high price for gas under any circumstances, then everybody's gas price will be kept low.

Suppose consumers of other commodities had the same privilege.

Renters and buyers of homes could keep housing prices down very simply. We have had rent controls during war periods, of course, but they applied only to an individual lease on a specific property.

If renters had a system like gas consumers, they could prevent anybody from building or buying a high-priced mansion because that might give other landlords fancy ideas and would tend to raise property valuations. By the same token, renters could exert federal control to prevent developers from paying much for land, or for lumber, bricks, or fixtures, and thus keep housing prices permanently at a low level.

Eaters, too, ought to get the Supreme Court to order up the same sort of deal for them. Then they could have a Federal Food Commission to require farmers to keep on producing wheat, vegetables, and livestock but with their prices rolled back to where they used to be.

Furthermore, this commission could order that sirloin steaks be priced as low as hamburger because it doesn't cost any more to produce one part of a cow than another part. Also, anybody, even if he could well afford it, would be forbidden to offer more for sirloin than for hamburger because that would break the price ceiling.

That's the way it works with natural gas. Suppose a producer develops a big reserve of high-quality gas located near a pipeline serving, say, the upper Midwest, but wants a little higher price than somebody else got for some other gas some time ago, and suppose the pipeline finds some potential customers in its territory eager to get the gas at that price, they can't make a deal because the political spokesmen for consumers on the Atlantic Seaboard will get the FPC to rule that nobody should be allowed to pay more than so much for gas anywhere under any circumstances.

So far the system has worked fairly well. It hasn't prevented an increase in the price of old gas to old customers, but it has kept new purchasers from buying new gas supplies at prices they were willing to pay, and thus protected them from their own folly. The theory is that if gas is denied people who are willing to pay more for it, the supply will be preserved for those who would rather pay less.

It's easy to understand why gas consumers want to keep this unique regulatory system. If Congress ever changes it they will be cast adrift to the mercies of the free-enterprise system just like the consumers of every other commodity.

—Henry D. Ralph

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BAKER REMEDIAL AND STIMULATION TOOLS

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What's wrong with marketing—No. 2

THE IDOL OF AMERICAN BUSINESS is mass production. It has brought success to many enterprises by bringing down the unit cost of manufacture low enough to create big new markets.

It has also brought failure to some companies who got carried away with turning out a volume of product in excess of the quantity, or not of the type, that the market desired.

That is a basic fault of the oil industry, where mass production is known as the incremental barrel. With high fixed charges, any additional throughput greatly reduces the unit cost of the extra production. And the oil industry is so volume-minded it fails to see the trap this builds.

INCREMENTAL BARRELS are that crude oil run in excess of a refinery's normal market requirements. By plant-bookkeeping methods, they are the cheapest barrels the refinery produces. That is a fallacy that has brought disruption to the gasoline market.

It works like this: The industry's growth mania leads it to overbuild refining capacity for a market which fails to grow as fast as assumed. Its obsession with low unit costs resulting from volume throughput invites each refinery to produce more gasoline than its customers can use.

The extra gasoline must find a new outlet. And since it is incremental it can be sold very cheaply. But this low-priced gasoline does not create additional consumption. It simply takes customers away from other suppliers. These other suppliers also are volume-bent and also have incremental barrels, so they retaliate in the same fashion.

To protect his regular market (which is supplied by the higher-cost nonincremental barrels) a refiner dumps his incremental barrels in other than his normal channels of distribution. There are a great many ways of doing this, but they all add up to price cutting and market raiding.

All over the country many other refiners are dumping their incremental barrels and taking each other's customers in the same way. Soon everybody's markets are chaotic, consumption has not been increased, all prices are reduced, and the average unit price of all gasoline manufactured is lower than if the incremental barrels had not been made. Thus the incremental barrel is a refiner's most expensive, not his cheapest, barrel.

MASS PRODUCTION WORKS when it lowers unit costs so that a big new consumer demand is opened. It backfires when excess production forces unit prices below costs without expanding consumption.

Oil's self-deceiving attitude that the only road to profit lies in decreasing unit costs by increased volume drives it to produce all possible, regardless of consumer needs or market consequences.

What is called marketing becomes only a pell-mell effort to get rid of material. The emphasis is on the product, whereas it should be on the needs of the market, as will be discussed in the next editorial in this series.

Shamals by Synoptics*...

THE SHAMAL WINDS – violently unpredictable – could spell sudden disaster for this mobile drilling platform in harbour at Das Island, in the brief, critical period of being moved at sea. But now the bogey of these ancient waters has been countered – by modern meteorology. *Adma Enterprise* with its drilling rig (owned and operated by BP in association with French interests) waits in berth till synoptic weather reports are assembled from the new network of weather stations in Iran, Kuwait, and South-East Arabia. It will proceed only when the "all-clear" is given. British Petroleum has taken a leading part in organising these Weather Reporting Stations. Thus drilling and pipe-laying operations, as well as shipping, now proceed more securely in these deceptive waters.

BP

* *"Synoptic meteorology is a weather-reporting technique based upon the collation and comparison of simultaneous reports from different areas."*

Pressure grows on crude prices

Cuts in the Rockies are another depressing factor on Mid-Continent crudes. A break in this area could peril others. Note of hope: Many executives want to firm prices by restoring strength to products markets.

Where price changes have occurred

EAST TEXAS FIELD:
Sun, Mobil, General American, Sohio, Panola, Ashland, Scurlock, Humble cut 15 cents to a $3.10 posting. Premier cut 5 cents and Atlantic raised 5 cents to same figure, putting about 105,000 bbl. daily of field's 128,000 bbl. production at $3.10.

EAST TEXAS AREA:
Humble raised 10 cents to $2.70 in Hawkins, Hitts Lake, Sand Flat, Sugar Hill, and Talco and to $2.21 in Prewitt Ranch, all involving 33,000 bbl. daily. Scurlock cut 9 cents to $3.06 on 20,000 bbl. daily in Panola, Carr, Harrison, and Marion. Pure cut 15 cents to $2.98 on 12,625 bbl. in Van, Bud Lee, and Mount Sylvan. Pure cut 15 cents to $3.00 on 4,500 bbl. daily in Fairway field.

LOUISIANA:
Humble cut by an average 10 cents on 28,000 bbl. daily in eastern and Central Louisiana fields. Cities Service cut from 5 to 20 cents in North Louisiana. Placid reduced by 5 to 15 cents in central area. Pure cut 10 cents to $3.10 in Creole and to $2.90 in Sweet Lake, involving 2,150 bbl. daily. Indiana cut 5 cents at top and changed differential from 2 to 3 cents for cuts averaging from 5 to 26 cents in North Louisiana.

ARKANSAS:
Sohio cut 19 cents in Wesson and North Stephens. Cities Service cut by 5 to 20 cents. Lion cut 10 cents in all areas except Magnolia Lime 15 cents and Louann, Camp Creek and Northwest Lisbon (Blossom) 8 cents with 35,000 bbl. daily affected.

WEST TEXAS:
Indiana changed differential from 3 to 2 cents which averaged about an 8-cent increase. Continental cut 6 cents to $2.95 on New Mexico sour.

ROCKIES:
Indiana cut 7 cents in Elk Springs, Isles and Rangely. Pure cut 15 cents to $2.78 on 40,000 bbl. daily in Denver-Julesburg. Sinclair cut 15 cents also on 20,000 in Denver-Julesburg.

THE delicate balance of the nation's crude prices has been shaken. And there's a possibility in the next few weeks of a series of price cuts in major producing areas.

This market uneasiness replaces one of confidence expressed in nearly all quarters only a few days ago. It stems directly from a 15-cent lower level of crude prices shaping up in the Denver-Julesburg basin.

Lower prices in the Rockies immediately put pressure on crude prices in the Mid-Continent—Kansas, Oklahoma, and the Illinois basin.

Big fear among producers is this: If Mid-Continent prices crack, the pressure then will be on West Texas, Arkansas, and North Louisiana crudes. The weakness could easily spread and involve the Gulf Coast and practically all other producing areas.

Adding even more pressure to the situation are the ruinously low prices refiners are getting for gasoline throughout the Mid-Continent and in spotted areas all over the country.

The wholesale price for gasoline in the important Group 3 market for northern shipment from Oklahoma is 9.5 cents per gallon for 91-octane regular. That's the lowest in 11 years and about the same price kerosine brings.

Sloppy gasoline prices through most of the summer motoring season have played hob with refinery realizations. They are off 30 cents a barrel in the Mid-Continent. This undoubtedly will be reflected in depressed third-quarter profits. Unless

refiners can restore prices, they have few areas of cost-cutting left except in the price of their crude raw material.

1. Some strength

Fate of the crude-price structure actually will depend on how each individual company views its relative position.

All crude buyers are known to have their posted prices under close study.

One hope prevails, however. The industry generally is not in a price-cutting mood. Many company executives say privately they would prefer to leave the price of crude alone and restore strength to products markets if possible.

Spokesmen for Humble and Continental in Houston say they do not interpret lower prices in the Denver-Julesburg basin as setting a trend for the United States. Continental says it is not planning any crude cuts. Humble officials explain recent price changes in the general East Texas region were only adjustments to bring prices of those crudes into line with competitive crudes.

Humble data on the recent changes in Texas, Louisiana, and Arkansas show 324,000 bbl. daily of production was increased in price by an average 11 cents per barrel while slightly more than 400,000 bbl. daily were cut nearly the same average price. The net change, a Humble spokesman says, is not highly significant.

One major buyer which recently adjusted its prices in several fields says the overall result of the changes is an increase.

If enough company executives take the same view as Humble and Continental, crude prices might be held long enough for a new upward trend to develop in the product markets.

And there are some — although admittedly few—favorable straws in the wind for products. Several Mid-Continent refiners reportedly have informed brokers they will not go along with the latest cut in published gasoline prices. They are going to try to hold the line for a higher price. Discounts on published prices, as a result, are harder to find. And this could mean the Mid-Continent gasoline price has bottomed out and that prices could be pushed up if product supplies are managed adroitly.

Prices of heating oils are reported fairly firm in most markets, but they need colder weather to create a demand for them. With a little luck in the way of weather and firmer gasoline prices, the products market might be able to ease the pressure on crude prices. Only a little time will tell.

2. How cuts developed

Pure Oil Co. made the first cut in Denver-Julesburg prices, and Sinclair followed.

Pure cut 15 cents off the top price, moving it from $2.93 to $2.78 a barrel on about 40,000 bbl. daily of purchases. Sinclair met this price on 20,000 bbl. daily of its own purchases and 8,000 bbl. daily for British American which is tied to the Sinclair posted price.

So two moves reduced the price on 68,000 bbl. of the total basin production of nearly 80,000 bbl. daily.

The third major buyer, Indiana Oil Purchasing, did not move immediately nor did any other buyers in the broader Rocky Mountain area.

Pure explains its move is an adjustment to put prices in its four producing areas into line with other competitive crudes. The company also made 15-cent cuts in the Van field area in Texas and 10-cent cuts in the Creole and Sweet Lake fields of Louisiana.

The Pure moves actually were tied to the recent East Texas field adjustments where buyers generally settled on a $3.10 price tag. This is 15 cents lower than the top flat price which had prevailed for years.

This 15-cent reduction in East Texas reportedly affected Pure's prices in the Denver-Julesburg in this manner: Sun and Sohio move crude from East Texas and Louisiana points north b ythe Mid-Valley pipeline to the Toledo refining area. Pure moves Denver-Julesburg crude east into its Toledo refinery, reselling or exchanging what it doesn't need for the plant. Thus the two crudes are competitive.

Both Pure and Sinclair are crude-deficit companies. They need more crude for their refineries than their production can provide. This has made them—and others in a similar crude position—particularly vulnerable when gasoline price wars hit.

Crude competition. The threat of lower Denver-Julesburg crude prices to other areas is a matter of simple arithmetic.

Denver-Julesburg crude competes with Kansas, Oklahoma and Illinois basin crude in the Kansas City, southern Illinois, and Chicago refining centers. It competes with East Texas, Illinois basin, and Canadian crude in Toledo.

In the Chicago market, for example, at the new price of $2.78 per barrel, Denver-Julesburg crude will lay down at about $3.18, while Oklahoma sweet, priced at $3.05, will lay down at about $3.42.

Even though Oklahoma sweet is considered a superior grade, it will never command this kind of premium price. But what is even more critical, the Denver-Julesburg crude under its new price can be laid down in some Kansas and Oklahoma refineries cheaper than the local crude.

3. Source of trouble

The price predicaments of both crude and products can be traced to changed operating patterns of refiners.

The level of runs seems to move farther and farther away from the demand pattern each year.

In 1960 refinery runs in August were almost as high as runs in January. This year August runs were higher than runs were in the peak of winter. And peak winter demand is almost a million barrels daily higher than August demand.

All that the current operations have done is transfer surplus oil from crude storage into products storage. Some economists argue this has a deceptive effect on producers and a depressing effect on marketers' prices.

The reasoning runs like this: Refiners are badly miscalculating their runs and as a whole are over-producing their needs, thus building up excess product stocks. These stocks tend to drive down product prices. Refiners actually should produce closer to demand and keep their surplus oil in crude storage.

But the ultimate effect of current refinery operations actually is the depressing of prices for both products and crude. The result: A double loss on the crude.

Justice loses bid to kill Honolulu sale

Injunction denied by San Francisco judge. Divestiture suit will be filed, but ABC-type sale to Pan American and Tidewater will be closed this week.

HONOLULU Oil Corp. won its long fight to sell out to Tidewater Oil Co. and Pan American Petroleum Corp. last week when a federal judge in San Francisco denied Justice Department an injunction which would have killed the sale.

Dismissing the injunction means Honolulu and the buyers can now close out the $361-million deal this week (October 18). The closing is scheduled in Wilmington, Del.

But the real significance of Honolulu's success is that ABC-type sales can still be made. There has been wide speculation among oil men that ABC-type sales were dead due to opposition from the Internal Revenue Service.

However, earlier last week Honolulu and the buyers received a favorable tax ruling from IRS. The ruling may not have been a blank check to close any type of deal, but the companies have said the ruling is sufficient to close this particular deal.

In fact, Honolulu, Tidewater, and Pan American were guarded in their appraisal of the ruling.

Honolulu's lawyers announced that "based upon preliminary inspection by the company's tax counsel of the rulings, they appear adequate to permit consummation of the transactions."

Tidewater said a preliminary examination "indicates the ruling satisfactory for our requirements," and Pan American issued a similarly careful statement of its opinion of the IRS action.

What next? Even though the injunction was denied last week, Tidewater and Pan American haven't heard the last yet from the Justice Department.

Lyle Jones, head of the Antitrust Division in San Francisco, says his office will amend its complaint and file a divestiture suit in connection with the sale. However, no action can be taken to stop the closing this week. Any additional action will come after the closing date.

Judge Lloyd Burk, who dismissed the injunction from the bench, pointed out in his ruling that Justice has adequate recourse through a divestiture suit if the department wants to press its antitrust charges.

The injunction sought last week was based primarily on claims that Tidewater and Pan American would be acquiring crude supplies which go to smaller and less integrated firms. However, a recent proxy statement issued by Honolulu showed the majority of its crude goes to major oil companies (OGJ, Oct. 2, p. 107).

Oil fights FOR higher gas tax in Missouri

ANOTHER gasoline-tax battle is under way in Missouri.

But this time oil men who have successfully fought higher taxes in the state are on the other side of the fence. They're campaigning for a 2-cent increase in the state gasoline tax.

There's a relatively simple explanation for this turnabout:

If the industry wins, gasoline taxes levied by more than 100 governmental units will be killed.

Currently municipalities can tax sales as much as 2 cents a gallon. To rid Missouri and the industry of this expensive multiple-taxing approach, the state Oil Council, Farm Bureau and County Judges Association devised a package plan which was adopted by the legislature.

Features of the plan include:

A temporary increase in the state tax from 3 to 5 cents a gallon. (This increase went into effect Friday.)

A constitutional amendment stripping cities and towns of gasoline taxing powers.

The election on the amendment has tentatively been set for March 6. If a majority of those voting favor the amendment, the 5-cent tax will become permanent.

Gains for all. The way the Missouri Oil Council figures it the plan has something for everybody.

Total revenue from the 5-cent tax would be approximately $80 million a year. Eighty per cent of this—$64 million—would go to the State Highway Department. The state take from the 3-cent tax this year would have been $48 million.

Cities would get 15% of the 5-cent tax pie, or $12 million. The sum would be divided in such a way that no city would receive less than its 1960 revenue from municipal gas taxes. And several hundred cities which have not been using this taxing power would get a share.

Counties would get 5% of the total. They have received no funds from this source so they would have a net gain of $4 million.

Getting cities out of the gasoline tax field would reduce tax-report expenses of marketers.

Support—but. The tax plan has won the approval of a number of organized groups in the state.

The Oil Council says those who favor it include the State Chamber of Commerce, State Highway Department, Good Roads Association, State Republican Committee, Democratic Governor John Dalton, and the AFL-CIO.

There is no organized opposition, the council says. However, a spokesman believes the campaign will be a tough one.

"On several occasions we have won the support of the voters in fights against tax increases," he says. "Now we have to try and swing them the other way, and it may not be easy."

Hole in the ground stores frigid LNG

Conch, Constock Pritchard show off their inexpensive, safe new technique for storing liquid methane—a hole in frozen ground with a gas-tight cover.

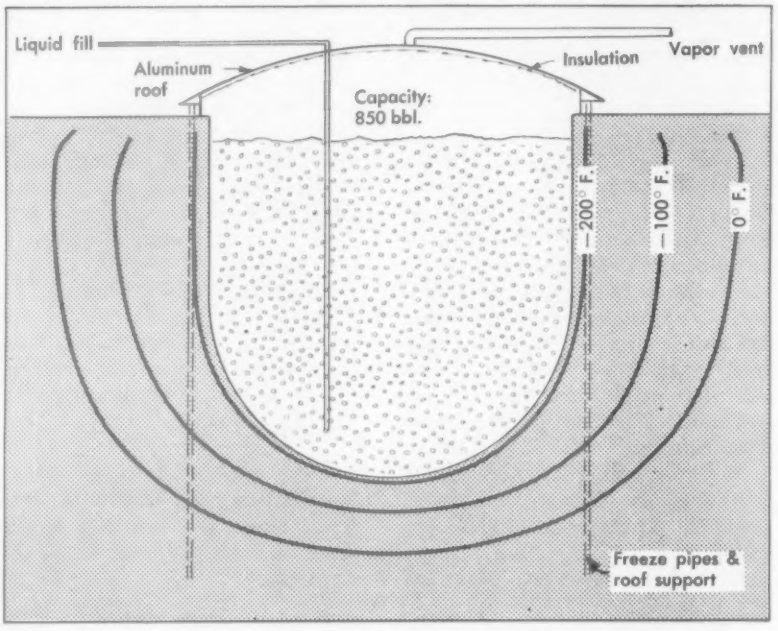
OIL AND GAS men last week were shown how to store liquid natural gas in a frozen hole in the ground.

Conch International Methane, Ltd., and Constock Pritchard Corp. demonstrated their "frozen earth" technique at a site near Lake Charles, La.

On exhibit was an 850-bbl. storage pit capped by an insulated aluminum roof. The pit has no lining. The −258° F. liquid is contained only by the surrounding frozen earth, which forms an impermeable barrier and prevents escape of the product.

The technique was developed as the companies searched for an inexpensive, simple, and safe method of storing the frigid liquid. It is cheaper than any form of aboveground storage, its developers say, and will be safer because it eliminates any dangers of rupture which are possible with metal tanks.

How liquid methane is stored underground



CAVITY is 20 ft. in diameter, 20 ft. deep. Black lines show temperature of earth surrounding stored LNG after product has been in storage 30 days. Distance of 0° line from wall of cavity is about 8 ft.

The method. To develop the 20-ft. diameter storage facility, workmen first drilled 30-ft.-deep holes in a 28-ft. circle. These were used for "freeze pipes" which circulated refrigerant to freeze the soil. Ground-water level at the site was 2.6 ft. below the surface.

When the frost boundary had moved inward 4 ft., leaving a 20-ft. unfrozen circle in the center, workmen excavated the cavity. With this done, the roof was installed and sealed to the ground. The walls of the hole then were sprayed with liquid methane to further cool them and to prevent thermal shock, with possible resulting fractures.

The storage pit then was filled with the liquid methane.

Constock and Conch officials made regular checks and after 30 days found no sign of a gas leak from the pit.

Advantages. With the frozen-earth technique, the companies figure no diking will be required, and pits can be spaced more closely than aboveground tanks.

With this saving in real estate, combined with lower costs of construction, the underground pit will be much cheaper than aboveground storage, even though individual projects may vary in cost.

Boil-off losses from the pit, Conch says, are about the same as would be expected from aboveground tanks, but only one-eighth of the insulation is required.

The Lake Charles project is a prototype facility built to prove the theory that frozen earth would provide an adequate barrier for the −258° liquid and to obtain actual construction experience.

Need is coming. The companies indicated this method will be used for large-scale installations when needed.

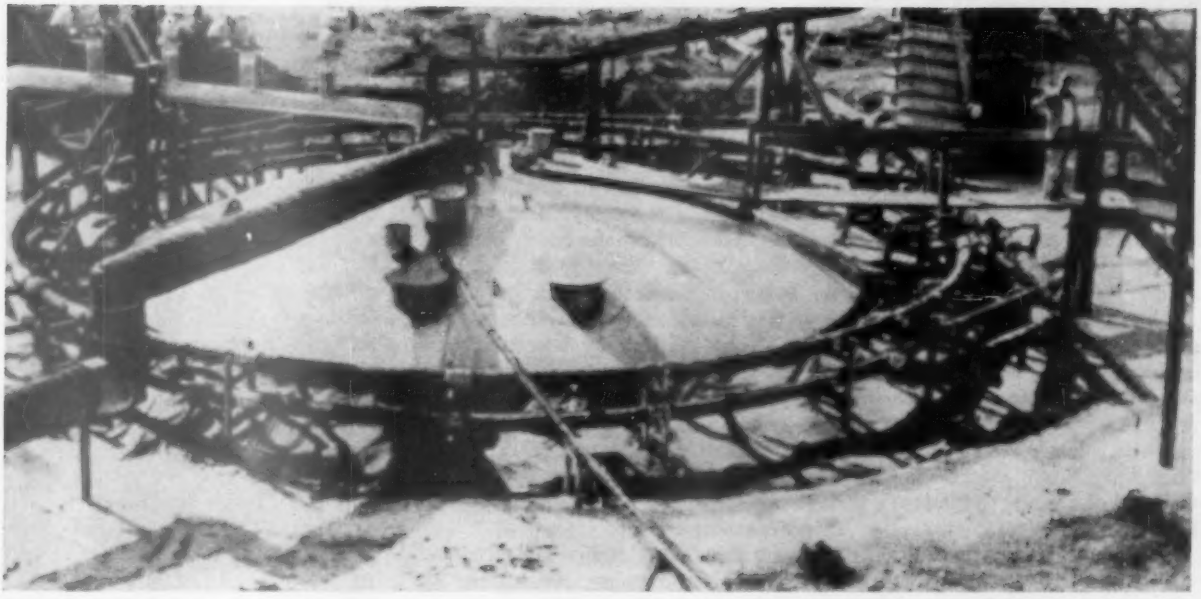
And they may be needed soon. The British Government is expected to approve in the near future—perhaps this month—a plan for large-scale imports of LNG from gas fields in Africa.

Conch and Constock Pritchard have been under pressure to develop economical and dependable storage for LNG for such commercial use, since low-temperature storage will be needed at all points of liquefaction and delivery of the liquid.

Conch is owned by Continental Oil Co., Canadian Shell, and Union Stock Yard & Transit Co. Constock Pritchard is owned 50% by these three firms and 50% by J. F. Pritchard & Co., Kansas City engineering and construction firm.

Member companies have been involved in research into LNG for 9 years. The work was climaxed in 1957 with construction of a gas-liquefaction plant at Lake Charles and the project, jointly with the British Gas Council, to ship liquid methane from the Gulf Coast to England.

The "Methane Pioneer," jointly owned by Conch and the Gas Council, made its first trip to England in 1959 and completed seven round trips before the experimental project was completed.



FINISHED STORAGE facility, showing aluminum roof and aboveground connections. Roof rests on freeze pipes.

REFRIGERANT system used to freeze ground before excavation. Outer ring carried coolant to be pumped down freeze pipes.

EXCAVATION was begun after ground was frozen around a 20-ft. circle.

PROCESSING BRIEFS

Udex benzene-recovery unit with 12,500-bbl. capacity is being built at Mobil Chemical Co.'s Beaumont, Tex., refinery. Also under construction is 2,300-bbl. hydrotreater for purifying feed stock to the recovery unit. Completion is set for February with Fluor Corp., Los Angeles, handling construction.

Construction of a $6.5 million plant at Ponce, Puerto Rico, is planned by Commonwealth Oil Refining Co. It will be the firm's initial move into petrochemicals. The plant will produce 50 million pounds per year of naphthalene, using UOP's Hydeal process, and other products. Construction will start in January at the company's 80,000-bbl. Guayanilla Bay refinery, and the facilities are scheduled to come on stream about January 1963.

Propylene production capacity will be increased from 120 million pounds annually to 300 million pounds at Sun Oil Co.'s Marcus Hook, Pa., refinery. Construction on the $2.2 million, 180-million-pound expansion will start next month and is scheduled for completion in the second quarter of 1962. A $9.3 million gas-processing plant now nearing completion will supply some charging stock. Full capacity of the expanded facilities will be reached next October on completion of a $14 million catalytic-cracking unit.

Design work on the 50-million-pounds-per-year naphthalene plant to be built at Cities Service's East Chicago refinery is under way. A hydrodealkylation process licensed by Union Oil Co. of Calif. will be used to convert distillate stocks to high-purity naphthalene. Catalytic Construction Co. will handle construction of the plant.

Permian hearing told:

Gas producers must have incentive

THE QUESTION of whether this nation will continue to have an adequate supply of natural gas at reasonable consumer prices hinges on one thing: Adequate incentive.

That was the basic thesis of testimony presented by producer interests last week at the opening in Washington of the area-price hearing for the Permian basin.

Since this case is a pattern-setting one, its progress is being watched closely by the industry and the Federal Power Commission.

In last week's initial hearing, the written testimony of 14 experts was submitted, together with supporting exhibits. The testimony covered virtually every facet of industry operations—gas markets, reserves, and geological, engineering, drilling, operating, financial, and other functions related to natural gas—both nationwide and for the Permian basin specifically.

Through all the testimony ran the thread of thought that unless sufficient encouragement is offered to spur the search for development of the nation's gas reserves, the supply will eventually dry up.

It was estimated that U. S. supplies of gas already discovered and deliverable are only enough to fulfill present consumer demands for 10 to 13 years. For the Permian basin, a 6-year supply was estimated.

It was noted that exploratory efforts have declined more than 25% in the past 5 years, and that discoveries of new gas supplies are lagging far behind the rate of growth in consumer demand.

One big reason for this: Producer costs are increasing, and the uncertainty over price has discouraged the expenditures needed to maintain a proper rate of exploration and development.

"The exploratory trend is in the wrong direction if we are to meet increasing national demands for gas," Stanley Learned, chairman of Phillips Petroleum Co.'s executive committtee, said.

The point was made, too, that it is not enough simply to provide better prices for gas to be discovered later. It is necessary to make sure adequate prices are being paid for gas already being produced, because it is the source of the money needed to go out and find more gas.

"The industry by necessity gears its exploration and development activities very closely to current revenue," said Ira Cram, vice president of Continental Oil Co. and chairman of its board's executive committee.

Others have stake. The producer is not the only one with a big interest in the future of an adequate natural-gas supply. Roger Conkling, an engineering consultant, said in a statement that the other segments of the industry and consumers themselves have a direct interest in what is happening.

"It is no exaggeration to state that the safeguarding of the investor and consumer dollars which are now sunk in pipeline and distribution facilities and in consumer appliances rests upon continued supply," Conkling said.

There was no effort by those presenting testimony to recommend a specific area price for Permian basin gas. Rather, the group was concerned with presenting the factors that should be considered by the FPC in determining this and other area prices. It was apparently felt that the specifics on price should be taken up later.

Alfred C. DeCrane, counsel for Texaco Inc., made the opening statement for the producer group.

He said the group is not advocating "abdication of the commission's regulatory responsibilities." Nor, he said, does it contend that costs should not be considered as an aid to determining just and reasonable rates.

"Indeed, costs—in the sense of the industry's financial requirements needed to provide producers with the incentive to find and develop gas supplies adequate to meet consumer demands—are at the heart of the regulatory problem," he said.

The testimony last week was principally by the larger producers. Testimony of smaller producers and producer association intervenors, and others, will be presented next month.

Samuel Wenner, a new hearing examiner at the Federal Power Commission, presided last week.

What's ahead in Permian price hearing

THIS is the schedule for the immediate steps ahead in the Permian basin area-price hearing by the Federal Power Commission:

October 30—Deadline for filing motions to strike out testimony presented to the commission last week.

November 8—Deadline for replies to any motion to strike out testimony.

November 14—Presentation of written testimony by intervenors who support the producers (small producers, IPAA, TIPRO, etc.).

November 15—Cross-examination of producer witnesses who presented written testimony last week.

December 14—Presentation of testimony by the "opposition" (distributor groups, state utility commissions from "consumer" states etc.).

December 29—Deadline for motions to strike testimony offered December 14.

December 29—Deadline for producers who are required to file cost-data questionnaire.

January 5—Replies to motions to strike December 14 testimony.

January (exact date to be set)—FPC staff will present its arguments and a further schedule will be drafted.

Gasoline leads don't aid smog or endanger health, says Ethyl

ETHYL Corp. made its first defense against charges that TEL and TML are contributing to Los Angeles smog by flatly declaring there is no evidence after "repeated investigations" that lead antiknock compounds e i t h e r contribute to smog or endanger public health.

Robert A. Kehoe, MD, director of the Department of Preventive Medicine and Industrial Health at the University of Cincinnati, was Ethyl's leading witness at a legislative subcommittee hearing in Los Angeles last week. The hearing was called to discuss, among other things, a bill which proposes to outlaw the use of lead in gasoline.

Dr. Kehoe says tests show the lead content in the blood stream of Los Angeles residents is 30 micrograms, the same as the rest of the country, and has not changed materially in 20 years.

The lead content in the Los Angeles atmosphere is 2 to 4 times that of anywhere in the U. S., but the amount of lead absorbed into the blood stream rates evenly with the remainder of the country.

Unleaded gasoline? Over 99.5% of the gasoline turned out by the nation's refiners contain lead. The only unleaded gasoline is American Oil Co.'s superpremium, according to Ethyl.

Howard E. Hesselberg of Ethyl's Research and Development Department told the California lawmakers that taking lead out of today's gasoline would roll back the quality of gasoline 10 years and cost refiners 8 octane numbers (RON) under current refining processes.

Results of a recent study into whether changing the composition of gasoline would help solve the smog problem also were released at last week's hearing. The study showed altering fuel would not be as effective as keeping the composition at the present makeup and burning up all hydrocarbons with exhaust devices on autos. The state currently is studying various types of afterburners and expects to adopt two during 1961.

WATCHING WASHINGTON

with Clyde La Motte

Changing leadership will affect the course of Congress

LEADERSHIP in Congress is undergoing significant changes, thereby creating new situations for the oil industry to cope with in Washington.

For years there have been men in key positions in Congress who had a good working knowledge of the oil industry and its problems. Prime examples: Lyndon Johnson, Sam Rayburn, Frank Ikard.

But Johnson moved up to the vice presidency, Rayburn has been struck down by cancer, and Ikard is resigning his House seat to become executive vice president of the American Petroleum Institute.

Now new men are moving into those key positions. This does not mean an abrupt switch in policy, but it does mean gradual, subtle changes. Committee assignments, priority for one type of legislation over another, and shaping of the general tone of Congress are among the results to anticipate.

This changing situation once again underlines the need for the industry to make certain that top governmental people are provided with ample information on which to base oil-related decisions.

New FPC commissioners don't have to start from scratch

CALM EVALUATION of the work of Jerome Kuykendall and his more than 8 years of service at the Federal Power Commission—nearly all of it as chairman—makes one realize that he did a better job than is generally recognized.

(Kuykendall is leaving the commission January 1 to join a Washington legal firm.)

It is true the industry has been frustrated, irritated and dismayed by developments—or lack of them—at the FPC during the past 8 years. But Kuykendall ran the gauntlet of those same emotions in the turbulent, uncertain days that followed the Supreme Court's 1954 ruling in the Phillips case. His task was to clear a regulatory path through a new and hostile territory.

On the one hand he faced a producer segment that was convinced that regulation was neither necessary, desirable, nor feasible.

On the other hand he had to cope with a staff that was for the most part determined to apply strict utility-type regulation to gas producers.

And he was frequently attacked by courts in rulings which tended to stymie the commission at almost every turn. Meanwhile there were charges and counter-charges in Congress, where regulation had become a heated issue.

It was an untenable situation. Yet the commission did make some progress. It moved toward commodity value rather than strict cost as a basis for determining gas prices. It offered the area-pricing approach as a possible way to cut down the staggering backlog of cases.

The new commission appears to be aware of this progress, for it is not setting out to undo what the old commission did but to move forward from the point that had been reached.

There is still a long way to go. But Kuykendall and his associates did help set the stage. Their experiences, including their mistakes should be of value to the new commission. For this contribution, Kuykendall and his former colleagues are due a vote of appreciation by the present commission, the gas industry and the public.

Better gas prices realized by U. S. producers in 1960

THE AVERAGE price paid to the nation's natural-gas producers by interstate pipeline companies in 1960 was 15.6 cents per thousand cubic feet, the Federal Power Commission reports.

By comparison, the average price was 14.3 cents in 1959, 13 cents in 1958, and 12 cents in 1957.

FPC says the prices are unadjusted for variations in pressures, in B.t.u. or hydrocarbon contents, or for special facilities provided.

A state-by-state breakdown shows that producers in Texas averaged 13.6 cents, while Louisiana producers (including offshore) averaged 19.3 cents.

Average prices in other principal producing states include: Kansas, 12.4 cents; Oklahoma, 13.6 cents; New Mexico, 12.2 cents; Wyoming, 13.5 cents; and Mississippi, 20.6 cents.

Texas and Louisiana were by far the largest producers, supplying 73.7% of the nation's total.

Domestic-trade ships pay premium for East Coast resid fuel oil

SHIPS in international trade are able to buy residual oil along the East Coast at about 39 cents a barrel less than ships in domestic trade have to pay, a government report indicates.

The difference stems from bonded and nonbonded sales. Bonded residual fuel is imported oil not subject to import license and is used to fuel vessels in international trade. Nonbonded residual includes domestic resid and imported fuel subject to license. It is used by vessels in domestic trade.

The Office of Emergency Planning (formerly OCDM) issued its report last week covering East Coast residual-fuel-oil prices during July. This was one of a series of monthly reports made by the agency.

Over-all, the report showed no appreciable change in residual-fuel-oil prices along the East Coast over existing price levels for June.

SAND HOPPER is connected to one end of line and . . .

Low-pressure sand cleaning

THE DELIVERABILITY of a 39-mile section of 8-in. gas line running through southern California's Imperial Valley has been increased 8½% as result of a pipe-cleaning job.

Sand moved in a gas stream was used to clean the line. The sand moved at the relatively low pressure of 48 lb., but cleaned the line of scale and other deposits collected during the 13 years it has been in service. At this low pressure, the sand doesn't blast anything from the walls of the pipe, but smooths out the rough spots similar to sanding a flat wooden surface with sand paper.

J. T. Wootan, project engineer for Southern California Gas Co., said a time limit imposed by authorities of a Naval gunnery range didn't allow time to pig the line before the sand job. However, Wootan said any compressor oil which may have been in the line was cleaned out thor-

INDUSTRY BRIEFS

Offer to purchase Sun Oil Co.'s 160,000 shares of Houdry Process Corp. stock, valued at $11 million, has been made by Air Products & Chemicals, Inc. Sun's holding amounts to 47% of Houdry's 331,000 shares of outstanding common stock. Houdry has developed catalytic processes for oil and chemical plants, which it designs and builds.

Nitrogen fertilizers formerly sold by American Oil Co. now are being marketed by Tuloma Gas Products Co. Both are affiliates of Standard Oil Co. (Ind.). American this year dropped the fertilizer line to concentrate on petroleum-product sales.

Asbestos-asphalt paving is being tested on a street in Martinez, Calif. Purpose is to see whether asphalt containing 2.5% asbestos fiber will stand up better under heavy truck traffic than conventional asphalt paving. The Asphalt Institute is a sponsor of the experiment.

Canadian natural-gas production increased 25% during the first 6 months of the year over the first half of 1960, reaching 324 billion cubic feet. Natural gas exports to the U. S. were 87 billion cubic feet. This exceeded production for the full year 1959 and amounted to 75% of total 1960 exports of 112 billion cubic feet.

Sale of Blue Dolphin Oil Corp. to Wichita River Oil Corp. is in the works. Wichita River announced it will acquire the firm with 700,000 shares of Wichita River common

DISCHARGE diverter to other end . . .

CLEANING begins on one section. Sand truck stands by to start next section.

boosts throughput of natural-gas pipeline

oughly with the gas-sand treatment.

The gas stream moved into a sand hopper at 60 lb. pressure, picking up the sand. The weight of the sand dropped the pressure to 48 lb. as the gas-sand stream moved into the line. The sand is fed into the line in pulses of about 3 to 6 minutes, followed by a clean stream of gas to flush out any sand or deposits.

On the SoCal Gas job, sand was fed in at the rate of 110 lb. a minute. Several checks for erosion failed to show any measurable wear as result of the sanding.

There was no back pressure on the line since the sand was discharged into the atmosphere. Diverters were used to discharge the sand out of the pipe ditch, but aren't necessary for such cleaning jobs. The diverters also were checked for erosion (note circles on diverters in second photo), but none was found.

Two sets of equipment also were used due to the tight schedule. This permitted the cleaning contractor, Clean-Kote Corp. of Houston, to leap frog from one section to the next without waiting to move equipment. The line was cleaned in several sections, ranging from 3½ to 7½ miles long.

Several gas lines in the Gulf Coast area have used sand to clean interiors of lines, but the SoCal job was the first time the technique had been used on the West Coast.

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stock. Blue Dolphin has water-flood properties in Illinois and Indiana. Wichita River has crude production in Oklahoma and Texas.

Merger of Southwest Natural Gas Co. into Arkansas Louisiana Gas Co. has been completed. Both have headquarters in Shreveport, La. Arkla acquired facilities serving 45,000 customers in Louisiana, Oklahoma, and Texas. Also acquired were two Southwest Natural subsidiaries—Rocky Mount Gas Supply Co. and Southwest Natural Production Co. The subsidiaries hold leases on 34.851 net acres in Arkansas, Louisiana, Oklahoma, and Texas, of which 9,705 acres are producing.

Atomic Energy Commission test facilities near Idaho Falls, Idaho, will be operated another 5 years by Phillips Petroleum Co. AEC extended the operations contract through Feb. 28, 1966. The facilities are part of the National Reactor Testing Station. In addition to research and development work, Phillips operates the materials testing reactor, chemical processing plant, engineering test reactor, and special excursion reactor test plants.

Award for the best 1960 stockholders' report among integrated petroleum companies will go to Continental Oil Co. for the ninth straight year. Reports were judged on basis of content and presentation in a contest sponsored by Financial World.

Sale of C. L. McMahon, Inc., and Inland Producing Co. assets to Forest Oil Corp., San Antonio, Tex., is expected to be completed in December. Sale price was not announced. McMahon is a Tulsa-based company which has production totaling 2,400 bbl. daily in the Mid-Continent and Canada. Inland produces about 200 bbl. daily in Illinois, Indiana, and Kentucky, and headquarters in Evansville, Ind. Inland and McMahon are owned by the McMahon family of Tulsa.

Proposed regulation of natural-gas production in California will be discussed at a meeting of the state Public Utilities Commission December 4 in San Francisco. It will be the first of several hearings covering natural gas in Galifornia. The commission has invited interested parties to make statements "on whether regulation of the production of gas in California would be beneficial to the public interest . . ."

Biggest gas deal in industry's history

In billion-dollar proposal, Humble would sell more than 6 trillion cubic feet of in-place reserves; Monterey would build a 30-in. line to deliver the gas to Columbia Gas System. One feature: No price escalation.

THE BIGGEST natural-gas deal in history went before the Federal Power Commission last week.

The FPC was asked to approve portions of a billion-dollar transaction that will guarantee to eastern markets—with no escalation in rates—6.2 trillion cubic feet of gas over the next 30 years. Most of the gas would come from four King Ranch fields of Humble Oil & Refining Co.

Monterey Gas Transmission Co., a new middle-man transporter operating on a cost-of-service basis, filed the key application for authority to move the King Ranch gas in South Texas into the Columbia lines at Alexandria, La. Monterey will produce the gas from in-place reserves to be acquired through purchase of leasehold interests from Humble.

What's involved. The many-sided proposal pioneers a new way of opening up shut-in reserves to the public.

And the speed with which the FPC processes the bulky applications and exhibits may indicate just how serious the federal agency is in following Chairman Joseph C. Swidler's newly announced intention to expedite its business.

The applications disclose important new details of the Humble-Monterey-Columbia deal, which was first announced last April (OGJ, April 24, p. 72).

First, the contract between Monterey and United Fuel Gas Co., a Columbia subsidiary acting as purchaser, provides for no escalation in price at the point of production. The delivered price at Alexandria will trend downward from year to year as throughput increases.

Second, Monterey will buy from Humble the leasehold interests in fields containing 6.645 trillion cubic feet of gas (at 14.73 psia.). It will make the purchase in two transactions, one in 1962 and the other 4 years later. The first will cost Monterey $536 million, payable over 20 years, and the other will bring the total to well above $930 million, paying out in 24 years.

Third, Monterey has been set up so that no company owns a controlling interest. Humble owns 48%, Lehman Brothers, a New York investment house, 22.4%, King Ranch, Inc., 19.6%, and six other companies and individuals, 10%. Monterey contemplates later making a stock and debenture offering to the public.

Chief officers of Monterey are John R. McMillan, president, Donlin P. Murdy, vice president and treasurer, and Martin N. Erck, general counsel and secretary.

The line. Monterey, headquartered in Houston, will acquire its pipeline facilities both by purchase and new construction.

It will buy Humble's 238-mile, 30-in. line from the King Ranch gas plant to Clear Lake near Houston and 91.8 miles of 8-to-24-in. laterals which gather the gas from 86 reservoirs in North Alazan, Laguna Larga, Vibaros, and East Santa Fe fields in Kleberg, Nueces and Brooks counties, Texas. The cost: $27 million.

Monterey will build a 216-mile, 30-in. main transmission line to pick up the gas at Clear Lake and move it to the No. 9 compressor station of Columbia Gulf Transmission Co. near Alexandria, La. The line will cost $32.8 million. This includes two metering stations, plus two compressor stations to be built in 1964 and 1965.

Columbia Gulf, a Columbia Gas System subsidiary, will transport the gas from Alexandria to eastern Kentucky, near Leach, where it will move into other Columbia subsidiary lines for distribution to the public. It will, in 4 years, spend $67.3 million to add 391 miles of 30-in. looping and 79,900 hp. of new compression on its Alexandria-to-Leach line.

Deliveries. If all goes smoothly with the application, Monterey plans to commence deliveries on Nov. 1, 1962.

Starting slowly with throughput, it will move 124 million cubic feet of gas daily the first year, 210 million the second, 296 million the third, 382 million the fourth, and higher amounts in succeeding years to a top of 770 million by the eighth year.

Capacity of the line would be 259.5 million the first 2 years and rise to 423 million by 1965 when the compressor stations have been added.

The gas will move into Columbia's seven-state marketing area comprising Ohio, Pennsylvania, Kentucky, Virginia, West Virginia, Maryland, and New York, plus the District of Columbia.

The price. Monterey's proudest argument on behalf of its application to the FPC is that it is offering Columbia a stable price for its gas reserves over a 30-year period.

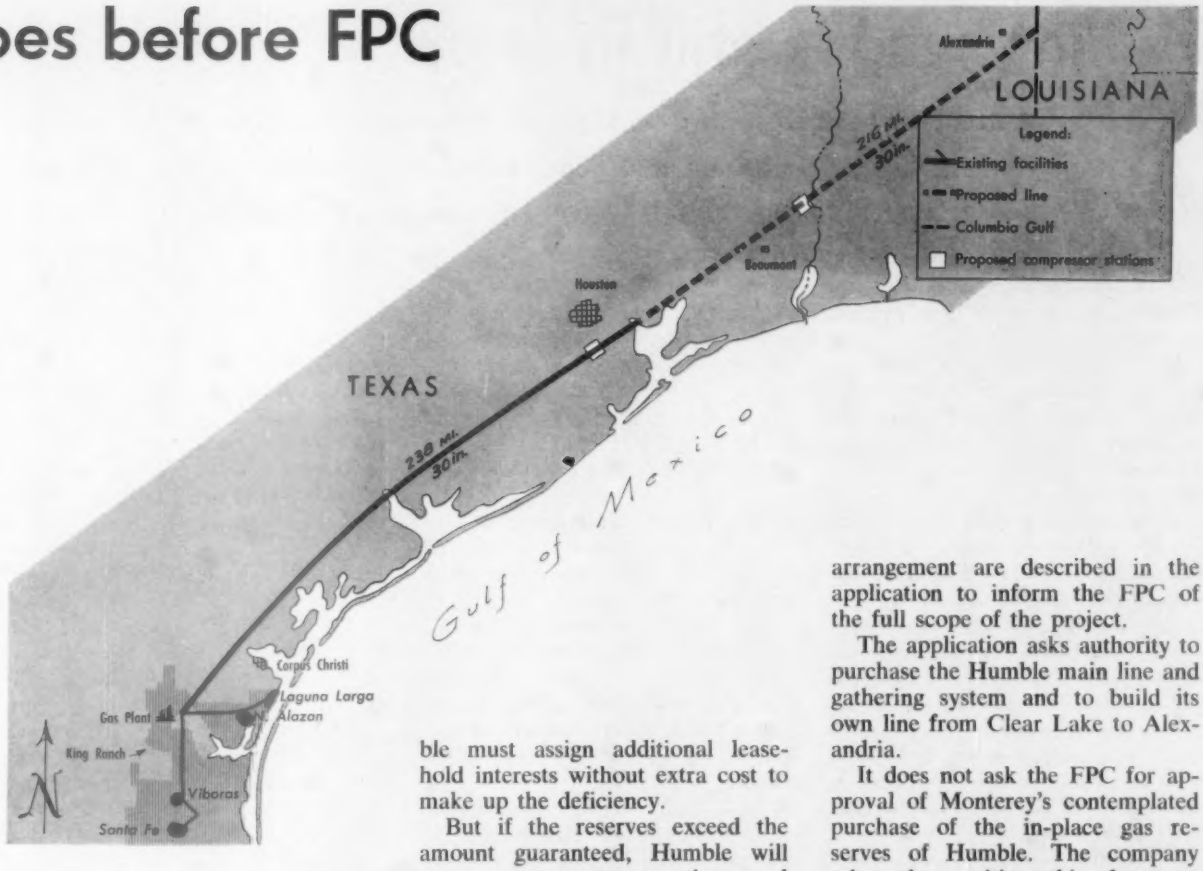
The basic cost of the gas is fixed by Monterey's initial $536-million purchase of Humble's leasehold interest covering guaranteed wet gas reserves of 3.757 trillion cubic feet. Monterey guarantees delivery of 3.487 trillion cubic feet of dry gas from these reserves.

Since the leasehold interests are subject to 15% royalty to the King Ranch (payable by Monterey), the rate figures out to be 18 cents per 1,000 cu. ft. of dry gas.

The delivery price at Leach, Ky., including such additional items as rate of return on investment, taxes, and transportation, will average 35.63 cents over 30 years, or about 2⅓ cents less than Columbia pays today for its Southwest gas. The rates are higher in earlier years of low throughput and drop eventually to 28.55 cents by 1992.

Monterey would earn a 6½% rate of return on its investment under the proposed rate schedule.

goes before FPC



Humble-Monterey. Before going to the FPC, Humble and Monterey executed a lengthy contract, which goes into effect upon approval of the pending applications by the FPC.

The contract provides for the sale of Humble's leasehold interests in the four King Ranch fields except that Humble retains a net profits interest in the crude and liquids.

The net profits so retained by Humble will be the revenues from crude and liquids sales, less the cost of developing and operating Monterey's leaseholds. Humble, in effect, thus retains all the non-gas production from the fields and at the same time makes it possible for Monterey to deliver high-pressure gas to Columbia without charging for production and gathering the gas, or for field and processing-plant compression.

Also in the contract Humble guarantees the reserves it is selling. Monterey can seek a determination of the reserves between the fifteenth and twenty-fifth years of operation, and if the reserves are insufficient to meet Humble's guarantee, Humble must assign additional leasehold interests without extra cost to make up the deficiency.

But if the reserves exceed the amount guaranteed, Humble will get no extra compensation, and Monterey will make the extra gas available to Columbia.

The applications. Monterey's application to the FPC covers only the first 4 years of its contract to deliver gas to United Fuel for Columbia.

However, details of the long-term arrangement are described in the application to inform the FPC of the full scope of the project.

The application asks authority to purchase the Humble main line and gathering system and to build its own line from Clear Lake to Alexandria.

It does not ask the FPC for approval of Monterey's contemplated purchase of the in-place gas reserves of Humble. The company takes the position this does not come under FPC jurisdiction, although details of the transaction, including the price to be paid for the gas, are contained in the filings.

As a consequence, Humble made no filing with the FPC in this important step to dispose of a portion of its vast uncommitted gas reserves, estimated at 25.7 trillion cubic feet.

Arctic wildcat reaches 1,600-ft. mark

THE FIRST wildcat in the Canadian Arctic islands was reported near 1,600 ft. last week—a month after the drill started boring toward its 10,000-ft. objective.

The $1,000,000 test is being drilled by a 17-company combine headed by Dome Petroleum, Ltd., Calgary. They expect to reach total depth by the end of the year. This is the first of several wells planned to explore a virgin area with estimated reserves, based on sediment volume, of 21 billion barrels (OGJ, July 3, p. 76).

Peter Bawden Drilling, Ltd., the contractor, landed a 11,500-ft. capacity rig at the Winter Harbor, Melville Island, location in late August. The test was spudded in mid-September. A crew of 23 and a Dome geologist will brave the Arctic cold and snow 1,500 miles north of Edmonton until the well has been completed. The mercury has already plunged below zero, and temperatures to −50° F. are expected.

Dome Petroleum is operator for a group including Round Valley Oil Co., Ltd. (Lobitos); Union Oil Co. of California; Canada Southern Petroleum, Ltd.; Tidewater Oil Co.; Clark Oil & Refining Corp.; Dominion Explorers Group, Bankeno Mines, Ltd., and Provo Gas Producers, Ltd.

Drilling wages still in state of flux

Dust hasn't settled yet around flurry of changes in drilling-crew wages and hours. Two big companies have gone to 48-hour week. What happens in South and West Texas may decide route most contractors will take.

THE drilling-crew-wage picture should clear up in the next couple of weeks.

Within that time span, contractors now hesitating are expected to go to a shorter work week with the same pay, or to a simple pay increase while retaining the traditional 56-hour week.

First contractor wage moves went the latter direction when a number of contractors followed a move by Penrod Drilling Co., Dallas, to grant a 10% pay hike on Gulf Coast rigs. Some Oklahoma contractors are raising wages as much as 10%.

But there is strong sentiment in the contracting industry that a wage hike isn't enough—that a shorter week is a must. And the impetus in the more recent wage moves has been in this direction.

Two big ones move. First move toward a shorter week came late in September when Baker & Taylor Drilling Co., Amarillo, Tex., cut to a 45-hour week with a 5% increase in gross earnings (OGJ, Oct. 2, p. 112).

At the same time, Moran Drilling Co., Wichita Falls, Tex., announced firm plans to cut to a 48-hour week with some increase in take-home pay.

The biggest boost yet for the shorter hours came last week when two of the industry's biggest contractors declared for a 48-hour week with the same take-home pay.

They are Rowan Drilling Co., Inc., Fort Worth, and Southeastern Drilling Corp., Dallas.

Rowan is putting the 48-hour week into effect on a rig-by-rig basis as it is able to negotiate footage rates high enough to permit it.

Southeastern is changing over with the start of the next pay period on all its domestic rigs.

New hourly rates with the 48-hour week, except in the Rocky Mountain area, are $3.52 for drillers, $2.66 for derrickmen and motormen, and $2.54 for floormen. For a driller, this amounts to a hike of 66 cents an hour from the old $2.86 rate, with equivalent increases for other crewmen.

The scale is slightly higher in the Rockies, running $3.58 for drillers, $2.72 for derrickmen and motormen, and $2.60 for floormen.

The Rowan plan. Using its rig-by-rig plan, Rowan Drilling at week's end already had eight of its rigs on the short week.

All but one of these are operating with five or six-man crews.

M. G. Rowe, Rowan president, said last week that he was highly pleased with operator acceptance so far of the company's short-week move.

"We had to bid considerably higher where we intended to go to the short week. These higher bids were accepted over normal bids made by competitors. And we feel this is plenty of proof of the operators' understanding of our labor problem and willingness to help solve it."

Rowe said Rowan will go with the short week until it is clear whether "we can or can't make it go." The plan, he said, must have support from a large number of contractors if it is to be a national pattern.

Rowan management, he said, feels the short week is a must for two reasons.

The first is "that we have to improve the lot of the employes we have now. They are long overdue for a lot better deal than they're getting.

"And, secondly, many of our old hands—our key people—who have stuck with us—are getting old. We have to do something to attract new blood. Young people today don't want to—and won't—work 7 days a week.

"We've had very little success in recruiting, and this condition is general throughout the drilling industry. A small wage hike without cutting working hours isn't going to change this."

Rowan is using a rotating relief system to keep drilling on a 7-day basis, while no one man works more than 6 days.

The other side. A goodly number of contractors, meanwhile, insist that general adoption of a shorter week would be a costly mistake. And they contend they'll have no part of it.

The opponents argue that those favoring such a move are naive if they think operators will stand still for footage rate increases high enough to pay the added labor cost.

The big majority of operators, they claim, are still taking advantage of their buyers' market and chiseling drilling costs by advertising widely for bids and picking the lowest.

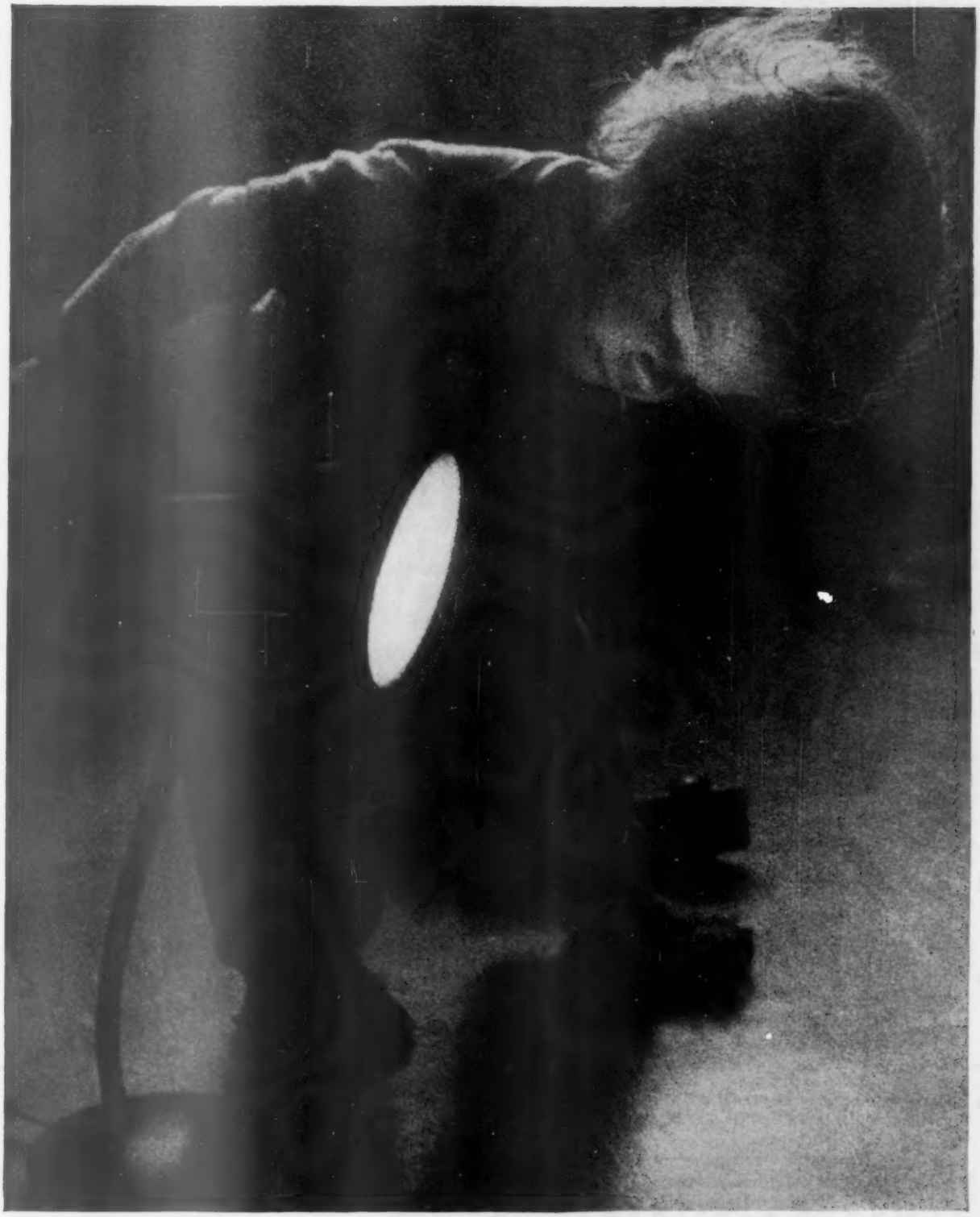
The opponents also say they are not having trouble keeping experienced hands under their present wage scales and 56-hour week. "We haven't had any shortage of top quality workers and don't expect to," said one contractor.

The key in West Texas. Some contractors feel that "as West Texas goes, so goes the industry."

A large group of West Texas contractors have been wrestling with the problem for several weeks. At least three meetings have been held on the subject. And another is coming up—probably this week. A decision one way or the other is expected from this meeting.

Roughly a dozen South Texas contractors met and talked over the problem during the annual AAODC meeting in Houston earlier this month. A South Texas move also is expected soon.

An effort to put over a 42-hour week at the Houston convention fell through when AAODC directors deferred action on a resolution by the Sound-Practices Committee calling for such action.



Curiosity sometimes disappears as the years pile on. This is unfortunate in any man—tragic in a scientist. But Ethyl's Laboratories are staffed with men who have never lost their curiosity about what goes on in the combustion chamber. That's why, after 38 years, every day offers new promise.

ETHYL CORPORATION, NEW YORK 17, N. Y. • TULSA • CHICAGO • HOUSTON • LOS ANGELES • ETHYL CORPORATION OF CANADA LIMITED, TORONTO.

Dealers like companies more

Survey shows there's less resentment toward policies nowadays, but gripes are still numerous.

DEALERS currently tend to have a kindlier attitude toward their companies, compared with feelings of 4 years ago.

They appear to be more understanding of company policies and do not feel their need for independence has been cut into as much as before.

Today the dealer is more apt to be antagonized by the public's lack of appreciation than he is to be antagonized by what he considers the wrongs of his company.

These were among the significant changes in attitudes of service-station dealers toward their supplying oil companies revealed in a motivation study made by Dow Chemical Co. The results were given to the marketing research committee of API Marketing Division during a session in New Orleans. It is the second in a series of such studies.

Charles W. House of Dow's national merchandising staff gave the report. He said dealers naturally still have a high interest in profits. But next to this the average dealer wants to feel he is regarded by the public as doing a worthwhile, respected, and honest job. This fact stresses the importance of the dealer's personal relationships with his customers and his employes as well as his company and its representatives.

High on the dealers' list of things appreciated: "Sympathetic understanding" from company agents, company interest and frankness, dealer training, company loans, credit-card systems, advertising and merchandising help, and a minimum of outside influence and direction.

Dealers also reflect pride in their products when their companies have substantial research programs to improve products.

What dealers don't like. Dealer gripes continue to be numerous.

They include such matters as regulation of hours, rentals of signs and credit-card machines, sales quotas and goals, and lack of flexibility in point-of-sale materials.

Dealers often feel gasoline profit margins are too low, graduated station rent is penalizing, there are too many service stations, and the year-to-year lease is too threatening.

They also complain of a company's disinterest because of its size, and of sufficient training for service-station operation. Dealer meetings are criticized as superficial and insincere. Some say the meetings have an atmosphere in which dealers do not feel free to ask pointed questions or to make critical comments.

Dealers criticize sales representatives for an air of superiority, inadequate practical experience, meddling in unimportant matters, and inability to answer policy questions.

Rig count in Alaska hits 21

ALASKA'S status as an oil area has grown to the point that the state now boasts 21 rotary rigs.

Only 10 of the rigs are running, but four were idled early in October when three wildcats were plugged as dry holes and another suspended. At least one or two rigs probably will start making hole again soon. Operators will be pressing their wildcat hunt again during the freeze in winter months.

One more rig is due to arrive in Alaska soon. Trinity Canadian Co., Ltd., Calgary, is preparing to move a rig into the state.

Of the 10 rigs running, four are on wildcat locations and six drilling in Swanson River field on the Kenai Peninsula. The six rigs in Swanson River are scheduled to remain active throughout the remainder of the year.

Coastal Drilling Co., Bakersfield, Calif., leads the list of contractors in Alaska with four rigs, but Reading & Bates, Inc., Tulsa, and Rowan Drilling Co., Fort Worth, both have three rotary rigs based in the state.

The accent on deep drilling in Alaska is obvious by the type of equipment available. Fourteen of the 21 rigs are rated at 12,000 ft. or deeper with 4½-in. drill pipe.

New Texas gas tax attacked in court by three pipelines

THREE interstate gas pipelines last week attacked the constitutionality of Texas' new dedicated-reserve gas tax.

Suits were filed in State District Court in Austin by Transcontinental Gas Pipe Line Corp., Panhandle Eastern Pipe Line Co., and Michigan-Wisconsin Pipe Line Co.

The court action was filed at the first legal opportunity—namely after the three firms had paid the first month's tax under protest.

The pipelines are employing the same line of attack used successfully in invalidating two previous Texas attempts to tax operation of the long gas lines.

Railroad Commission sets hearing on Texas pipeline-hookup rule

THE TEXAS Railroad Commission has scheduled a precedent-setting pipeline-connection dispute for hearing October 25.

The hearing was set on request of B. A. Duffy, Abilene, Tex., independent. It is being brought to force Crown Central Pipe Line to extend a pipeline connection to Duffy tank batteries near its gathering system in Haskell County Regular field (OGJ, Oct. 2, p. 114).

Duffy says his tank batteries are 1 to 2 miles from the pipeline.

If the case is not canceled prior to the hearing date, it will be the first test of the commission's June 4, 1958, order. The order contains general conditions under which common-carrier lines must connect producing wells owned by others.

Other petitions requesting implementation of the order have been filed before. But the issues were settled by the contestants before hearings could be held.

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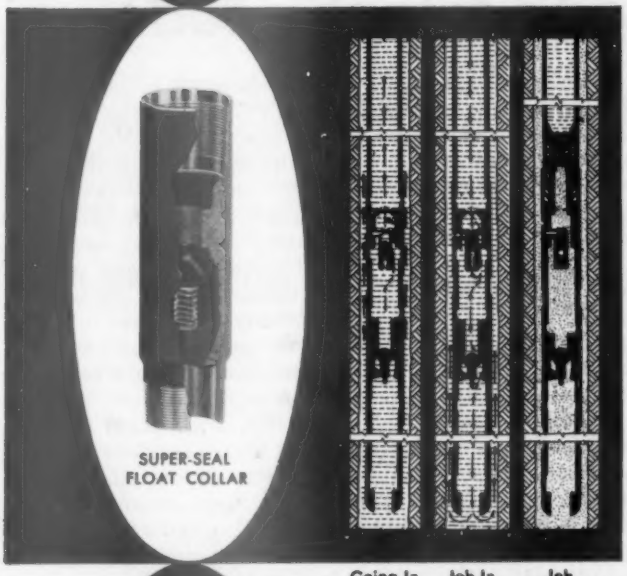

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CONCERNED PANELISTS* talked about oil's poor image, the problem of tailoring college training to oil-company needs.

SPE worries about oil's talent needs

MAIN concern at the petroleum industry's biggest technical convention last week was: "Where are we to get engineers of the quality oil must have in the Sixties?"

Preoccupation with this problem was apparent everywhere during the thirty-sixth annual meeting of the Society of Petroleum Engineers of AIME in Dallas.

"My theme for 1962," said Richard A. Morse, incoming SPE president, "will be to attack this sorry industry-image business. What's so repugnant about getting into an industry which is expanding worldwide about 6% a year? Oil is one of the most stable industries going. And opportunities are three times better now than when I got out of school."

And Lloyd Elkins, incoming AIME president, is tuned in on the same channel. He said AIME's biggest 1962 problem is "attracting the best talent possible into the mineral-engineering field."

Interest in the personnel problem appeared just as keen in the SPE ranks as at the top. For instance, the program devoted a full half-day session to the critical situation confronting petroleum-engineering schools, the adequacy of present training, and industry image.

PE schools to vanish. Future demand for new petroleum engineers, if current estimates are correct, will support only 8 to 10 PE schools of minimum size, John M. Campbell, Oklahoma University professor, told his colleagues in one presentation.

Demand estimates, he said, range from 250 to 400 new PE's annually. It takes at least 30 students in each class to support a good PE school. If annual demand is 300 a year, this means no more than 10 schools, he said.

The important thing, Campbell said, "is that we cannot justify the 25-plus schools and options we now have . . . Too many schools is like too many filling stations—no one does any good."

It would be better, he said, for a college to drop such a school and offer a PE option instead.

Suggestions to industry. The oil industry, Campbell said, definitely needs specialists trained in petroleum engineering for the foreseeable future. But if it is to get them, the industry must get busy. He suggested this program:

1. Carry on an effective employe-relations program so that the average employe can share management's long-range optimism. This isn't so now. And employe morale in many quarters is low.

2. Initiate and for the first time in history, carry out an effective public-relations program.

3. Start programs aimed at interesting the brighter high school students in a petroleum career.

4. Communicate its interest in the future of PE to university presidents and regents as well as PE staffs.

5. Give schools financial as well as moral support. Fellowships are fine, but the financing problem is far more basic. Farm out fundamental research. Sponsor an academic chair.

6. Modify "your feast or famine recruiting program that needs no one now and then starts crying for people 6 months later."

The SPE itself could help out greatly, Campbell said, by preparing and distributing forecasts of future manpower needs for use in school planning. Also by taking a positive role in raising the educational standards.

Educators, he said, should work with the industry in a drive to obtain more quality students. And they should carry on programs that really justify the interest and support of the industry.

Panel eyes tomorrow. The question of whether engineers now being turned out by PE schools "can meet tomorrow's challenge" brought vastly different responses from a panel of prominent industry engineers and educators.

The answer, according to Murray F. Hawkins of Louisiana State University, is a definite "yes."

The reason, he said, is that petroleum-enginering curricula have improved tremendously in the past few years—progressing more than any other engineering branch. PE

*Left to right: Dr. Fraser Allen, Pan American Petroleum Corp.; George H. Fancher, Sinclair Research, Inc., moderator; Dr. Carl Gatlin, University of Texas; Tom Frick, Atlantic Refining Co., and Murray Hawkins, Louisiana State University.

schools, Hawkins said, are rapidly dropping "unessentials," and the course is getting tough.

Too little time. Seconding Hawkins contention that petroleum engineer grads are getting better all the time was an industry panelist, Tom C. Frick, an ex-professor who is manager of Atlantic Refining Co.'s natural gas and products division at Dallas.

"Generally, the industry is pleased with your (PE school) product."

Most in the industry, he said, realize that a school simply cannot turn out the finished engineer. "There just isn't time."

There is, however, a need for more engineering quality, Frick said. "And I would advise wherever possible that you discourage the bad student and encourage the good."

In checking with others in the industry, Frick went on, "I found one unanimous criticism of today's engineering graduates—they lack the ability to communicate, either orally, or through written reports. And they show a lack of professional pride."

"What are fundamentals?" A third panelist, Dr. Carl Gatlin, head of Texas University's PE department, took to task those who contend that today's PE grads aren't sufficiently grounded in basics.

"What," he asked, "are fundamentals? This is the criticism I hear voiced most—and we don't understand it.

"Our PE students take more chemistry than any other engineering discipline except chemical engineers—as much physics as any other except electrical engineering . . . as much math as any other engineering branch . . . and geology which others don't get at all."

Gatlin cautioned the industry that its captive crop of petroleum engineers is getting "mighty thin"—and that its present poor image will prevent it from hiring many engineers in other fields.

Today's engineer lacking. A vote for some basic changes in petroleum-engineering education came from Fraser H. Allen, chief engineer for Pan American Petroleum Corp.

"Today's petroleum engineer, when he gets his diploma, won't be very well equipped to do the job he'll be asked to do. He will have to rely on the industry for much extra training to bridge the gap," Fraser said.

Some prime faults of present curricula, Fraser contends, are:

Mental discipline isn't keyed to computer technology. "The type of math still being taught doesn't equip an engineer to make maximum use of computers."

Students don't get the risk theory governing the oil business. "Petroleum engineering is the only engineering field involving risk . . . such as drilling dry holes, working on something you can't see a mile below your feet, and so on."

PE schools, Allen said, are now switching from the "know how" to the "know why" concept. "This is a good thing, but there's still a long way to go."

Progress in secondary recovery outlined

WHAT'S NEW in secondary recovery was outlined before the AIME's Society of Petroleum Engineers at their annual meeting last week in Dallas.

The engineers were told that:

Enriched gas drive in Seeligson field is showing a recovery efficiency approaching 100% in portions of the reservoir actually swept by the enriched gas.

Flooding with solvents shows promise under wide range of reservoir conditions.

Wettability of a reservoir can be reversed by use of caustic soda, with an increase in recoverable oil.

Enriched gas drive. Progress of Seeligson Zone 20B-07 enriched gas drive was reported in a paper by E. C. Barfield and W. C. Grinstead, Jr., Humble Oil & Refining Co. engineers (OGJ, June 30, 1958, p. 41 and July 14, 1958, p. 70).

In operation over 4 years, the project is showing recovery efficiency approaching 100% in portions of the reservoir actually swept.

But volumetric sweep efficiency is low, on the order of 23%, the authors said.

The reason has not been tied down yet, but Humble engineers think it is due to a combination of things, including adverse mobility ratio and sand heterogeneity.

Full evaluation will have to wait until later, so operations are being continued until some definite conclusions can be made about future performance.

Solvent flooding. Alcohols and similar solvents were used in laboratory studies described by J. W. Holm and A. K. Csaszar, Pure Oil Co.

Laboratory results showed that solvents soluble in both oil and water displace most of the oil in a simulated core. Tests were conducted at different conditions to represent a virgin, primary depleted, or watered-out reservoir.

Wettability reversal. Laboratory and field tests show that wettability of a reservoir rock can be changed with an increase in recoverable oil, according to a paper written by R. O. Leach, O. R. Wagner, H. W. Wood, and C. F. Harpke.

These engineers, all of Pan American Petroleum Corp. reported an additional 8,700 bbl. of oil production from previously watered out wells in West Harrisburg unit, Nebraska.

Lab tests had shown that ordinary caustic soda changed oil-wet rocks to water-wet, and a field trial was needed for further study. A portion of the West Harrisburg unit that had been depleted by ordinary water flooding was chosen so that there would be no doubt about the effectiveness of the caustic soda.

Three wells, temporarily abandoned because they had gone to 100% water, were put back on production, and caustic soda solution was injected into a nearby water input well.

One test well yielded 100 bbl. of oil, another 1,700, and the third none. But two nearby wells—not so watered out as the original three—also perked up. One recovered an extra 5,000 bbl. and the other 1,200 bbl., all credited to wettability reversal.

The authors concluded that early reversal of wettability in an oil-wet reservoir would improve water-flood potential.

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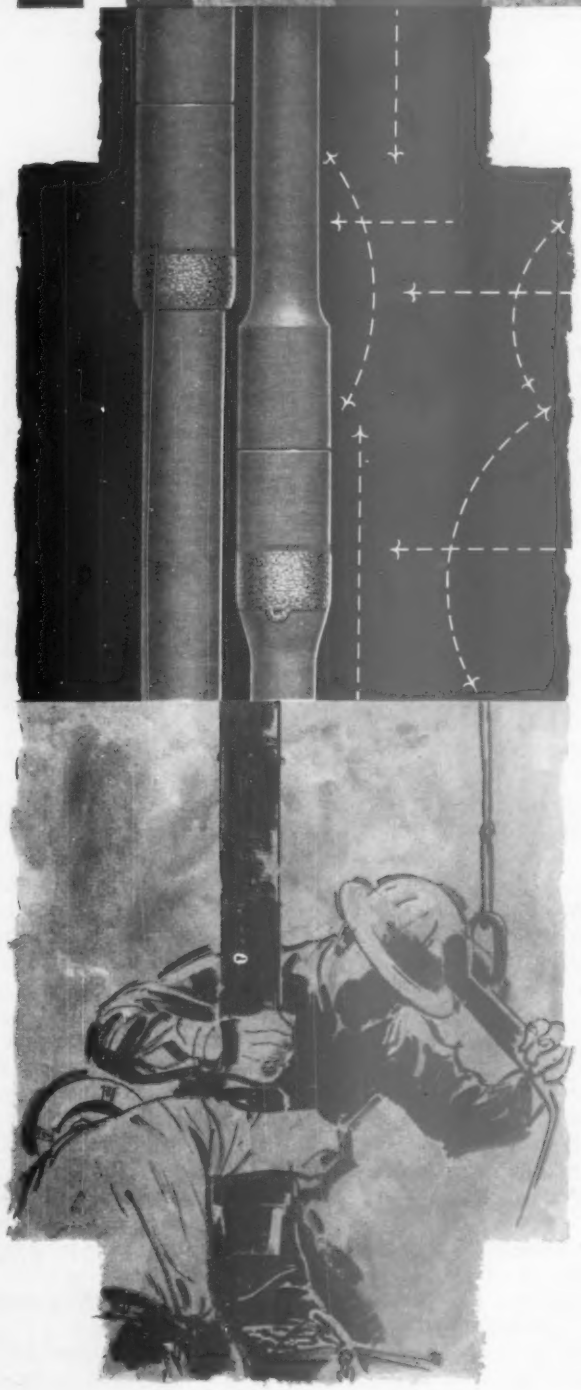

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SPE hears the latest in fire flooding

Pan American reports a 74% recovery in a pilot project in Wyoming's Shannon field. Sinclair reports a 59% recovery in its Kansas test. One difference: Fracturing had opposite effects in the two projects.

EXCELLENT recovery from two fire-flood projects was reported last week.

Pan American Petroleum Corp. told the Society of Petroleum Engineers of AIME in Dallas it had recovery 74% of the oil in place under a 1.32-acre pilot tract in Wyoming's Shannon field. And it indicated it might soon undertake a full-scale in situ combustion project.

Sinclair Oil & Gas Co. reported recovery of 59% of the oil in its Allen County, Kansas, experiment. Sinclair's work had been reported upon before (OGJ, Sept. 26, 1960, p. 113), but this was the first time any details had been given on the Shannon field project of Pan Am.

Here's what SPE was told about the experiments:

1. Shannon flood

Four Pan American researchers summed up the Shannon pilot this way:

No operating trouble of great importance occurred.

Inexpensive equipment was used throughout.

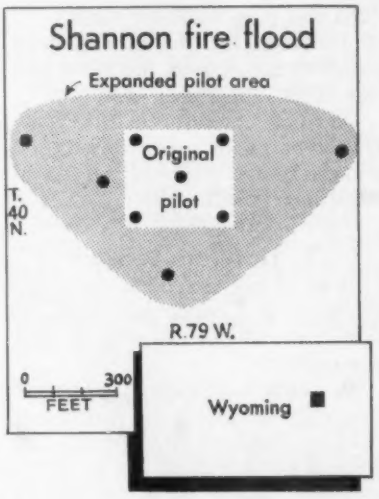
Premature gas breakthrough and poor oxygen consumption didn't affect success of the operation.

Ultimate recovery may reach that predicted in lab tests.

The Pan American paper was prepared by D. R. Parrish, R. W. Rausch, Jr., K. W. Beaver, and H. W. Wood.

Original pilot area was a 5-spot on a 1.32-acre tract (OGJ, Mar 27, p. 71). The four corner wells were cleaned out, and some were deepened to expose more oil sand. Original 7-in. or 8-in. casing was badly corroded, so new 5½-in casing was cemented inside, using a special high-temperature cement as a tail-in.

Gas injection was started in the center well in July 1958. Injection pressures were high at the start but dropped suddenly to about 700 psig at an input rate of 300 M.c.f. per day. Gas breakthrough to the corner wells was expected in about 35 days,



but occurred at all corners within 22 to 48 hours, they reported.

A formation fracture or severe formation stratification was suspected, but tests on the injection well and all producing wells did not show that either condition existed.

Production from the corner wells remained low despite the fact that reservoir pressure was increased and communication had been established between the injection well and the producers.

Reservoir pressure was increasing rapidly so the low producing rate was blamed on well-bore restrictions.

Fracturing the four corner wells proved successful, and production increased as much as eight times. Small frac jobs were used to avoid fracture extension into the injection well. About 500 lb. of 20-40 mesh sand was carried into the sand with 500 gal. of gelled kerosine, the authors said.

For a 4-month period starting in December 1958, injection operations were suspended for installation of permanent equipment. During this time, four additional producing wells were cleaned out and put on production, expanding the pilot area to about 5 acres.

Ignition. The formation was ignited with a bottom-hole, gas-fired heater in June 1959. Air was injected down the annulus, and fuel down the tubing. Excess air was used to try to hold the temperature of the gases going into the formation at about 1,500° F.

Analysis of gas produced at the corner wells showed a low percentage of carbon dioxide and an amount of oxygen that seemed too high for combustion products. It was thought that ignition had failed, and there was the problem of how to reignite the formation with no oil saturation around the well bore.

According to the authors, air injection was started in two of the production wells at the southern corners of the 5-spot. It was reasoned that if the formation were still burning, air injection in reverse combustion would improve the combustion rate.

Temperature surveys in the center well shortly after the start of injection in the corner well showed the formation was still burning. Engineers thought it necessary to clean out the center injection well before going on with the experiment but found the casing had been damaged during the ignition. They then had to keep the fire going because it was impossible to attempt reignition in the damaged injection well.

Reverse combustion was continued for about 6 weeks, with injection being switched to the other corner wells during the last 3 weeks to keep the flame advance in balance, the authors said.

In late August 1959, injection was resumed in the center well. Oxygen consumption had improved. Reverse combustion had been an excellent supplement to the ignition operation.

Breakthrough. About a year later, all production wells were refractured with an increase in production rate.

But the flow line from well 19 in the southwest corner of the 5-spot

was warm to the touch, and a survey showed the bottom-hole temperature had risen about 35° above normal. The combustion front had reached the well.

When well temperature reached nearly 400° F., water circulation was started to cool the casing.

The well was kept on production and continued to make oil and water for several months after fire breakthrough. By March 1961 the producing rate was so low that the well was shut in. No severe corrosion was detected, and all equipment appeared to be in good mechanical condition.

Performance. Through June 1, 1961, the original 5-spot wells produced 34,941 bbl. of oil, or 74% of oil in place.

Actual recovery rate is probably better than that.

2. Sinclair project

Surprisingly different results were reported in a paper describing Sinclair Oil & Gas Co.'s in situ combustion project in Allen County, Kansas.

L. W. Emery reported combustion efficiency was lowered by fracturing the producing wells. In those areas where wells were not fractured, combustion efficiency was actually higher, he said.

Also, after breakthrough of the combustion front, produced well fluid was predominantly water.

Recovery efficiency from the area swept by the Kansas fire flood was only 59%, Emery reported.

Air requirements were 20,000 cu. ft. per barrel of produced oil, and compression costs were pegged at $1.20 per produced barrel.

3. Hot-hole cement

Also of interest to fire-flood operators was a paper describing recent research on various cement compositions.

Wayne A. Walker, Halliburton Co., reported that a 1:1 mixture of calcium aluminate and calcined clay showed no change in size or shape and no cracking when exposed to temperatures ranging from 80° F. to 2,000° F.

Very little shrinkage and no cracking occurred in the specimens of calcium aluminate cement with 40% and 60% silica flour when fired up to 1,500° F. These combinations either melted or fused at 2,000° F., however.

All other mixtures tested either cracked excessively or disintegrated on being contacted with water after high-temperature firing.

Cracking may not be objectionable in producing wells used for in-situ combustion projects because they are usually abandoned shortly after fire breakthrough. Thus, any common cementing material could be used. But, if cracking is to be avoided, the calcium-aluminate cement containing either silica flour or some fine, granular refractory additive is strongly recommended, Walker said.

The fire-flooding papers and Walker's paper were among a number of reports on various technical processes presented at the meeting.

Elkins says oil MUST attract more engineers

NEW TOP BRASS of the AIME and the Society of Petroleum Engineers will concentrate heavily next year on attracting talent to the mineral-engineering field.

This, says Lloyd Elkins, 1962 AIME chief and director of research for Pan American Petroleum Corp., Tulsa, "is our biggest single problem."

"And it is going to remain the biggest problem for the next few years," he adds.

Elkins says the petroleum industry is running into some tough problems in attempts to hire talented engineer graduates.

"One of these is that young people are enamored right now with sciences—electronics and such. There they can immediately go to work in a nice clean lab. And working with their hands in an oil field or a mine just doesn't seem as attractive.

"Another is the argument from other engineering fields—and faculty members of these other fields in colleges and universities—that

Lloyd Elkins
"We have to get this across."

petroleum engineering is a 'one-industry' field."

College lobbyists in "broad-based fields" such as chemical and mechanical engineering try to convince bright underclassmen that career possibilities in petroleum are narrow, Elkins contends.

"That's the reputation we have, and we'll have to work awfully hard to counter it."

Where would he start?

"My own personal opinion," Elkins says, "is that we have to sell the opportunities in mineral engineering at the high-school and college-underclassman levels.

"Just how to go about it isn't clear cut.

"There are suggestions that companies might pick out bright college underclassmen and pay them—say $50 a month—while in school, with the agreement that they go to work for these companies when they graduate. It would be a form of scholarship—with conditions.

"Others feel this wouldn't be professionally correct, and would prefer instead a really intensive campaign of some kind to glamorize the industry and improve its attraction for young people.

"But the point is, we must do something to change the trend and soon—else the mineral industries are in for real trouble for engineering help."

Price war tests Socal's marketing plan

Recent Los Angeles hassle showed flexibility of new system, which pegs dealer price to the going price in a small area. Company is using this approach in West in hopes of firming up shaky West Coast gasoline market.

YOU'LL never be able to call Standard Oil Co. of California a price cutter so long as the company follows the area-pricing program now governing its marketing policy in the western states.

This was apparent last week by the prices posted by Socal during the fading days of a price war in Los Angeles.

The company's "net-to-retail" or dealer price is pegged to the going price in the area. This simply means Socal doesn't cut its dealer price until the majority of the prices in the area fall. By the same token, it doesn't raise prices until the majority of the other majors go up.

In other words, the new formula for changing dealer prices forces the company to follow rather than lead in changes. Socal can raise or lower prices at its company-owned stations at will, but its dealer or net-to-retail price doesn't move until the market moves.

The flexibility of the area-pricing program also was obvious during the recent price war. At the height of the price cutting, Socal had four net-to-retail prices posted in the 11 zones in metropolitan Los Angeles. Two of the 11 zones stayed at the same price throughout the war.

The company has sliced up the LA market in fairly small zones. This was done in hopes of keeping a price war from spreading and cutting in only those areas where the price is weak. The Socal plan differs considerably from wide-area pricing plans as far as the size of zones are concerned.

Why adopted. The company adopted its version of area pricing last summer in hopes of firming up the shaky West Coast gasoline market (OGJ, July 24, p. 50).

The company isn't saying the program has reached its goal, but says it does have "elements of stability" and will be continued.

A company spokesman points out area-pricing is a "posted proposition and there is no question in anyone's minds about what we're doing."

Dealer acceptance to date also has been satisfactory. One of the company's marketers says the dealers like the program because "everyone is treated the same."

During a price war, Standard of Cal splits the amount of a price cut with the dealer on a 75-25 basis. If a market is off 4 cents from normal, the company cuts the net-to-retail 3 cents or 75% of the amount of the decline. When prices move up, the net-to-retail goes up only 75% of the total market increase. This enables the dealer to pick up the 25% he paid in sharing the price cut with the company.

Market spread. As prices moved up again in Los Angeles last week, majors in most areas were posting regular pump prices at only 1 cent above independent dealers.

The 1-cent spread between independent and major dealers looks as if it will be a permanent fixture in California's market. This pattern emerged this year after a 3-month price war (OGJ, June 5, p. 33).

PIPELINE BRIEFS

First of three new pipeline terminals has been placed in operation by Kerr-McGee Oil Industries, Inc. It is on the Texas Eastern "Little Big Inch" products line at Clermont, Ind., and is Kerr-McGee's first terminal in that state. The others will be located at Chippewa Falls, Wis., on the Great Lakes line and at Madison, Wis., on the Badger line. All three will be supplied from Kerr-McGee refineries in Oklahoma.

A microwave system extending more than 1,000 miles from Longview, Tex., to Lima, Ohio, will be installed by Mid-Valley Pipeline Co., Longview. The system will have 43 stations including three terminals, 39 repeaters and a three-way junction station. It will have 24 channels plus fault-alarm channels. Fifteen supervisory and teletype channels will extend the length of the system.

Operating revenues of interstate-natural-gas pipelines totaled $269,122,631 in July, an increase of 7.2% over July 1960. Sales to other utilities were 553.2 billion cubic feet, an increase of 4.2%, and sales to direct consumers were 138.3 billion, a decrease of 6.5%, from July of last year. At the end of July this year, net plant of these companies was valued at $7,851,465,776.

Gross income of interstate-oil-pipelines set a new high of $770,417,060 in 1960, according to the ICC, against $765,232,073 in 1960. Net income, however, dropped from $182,815,269 in 1960 to $169,398,118 last year. An increase of $11.5 million in operating expenses and $6 million in taxes were largely responsible for the lower net. These pipelines were operating 49,401 miles of gathering lines, down 166 miles from 1960, and 102,567 miles of trunk lines, up 2,975 miles from the year before, as of December 31, 1960.

Fourteen miles of 10-in. feeder line are being laid in Henry and Rock counties, Illinois, by the Iowa Gas & Electric Co. Contractor is Gabe's Construction Co.

First annual meeting of the Distribution Contractors Association will be held in Kansas City, Feb. 5-7, 1962. Regular membership in the new organization totals 35 companies.

Caution marks forecast of oil growth

OPTIMISM is the key word in a 10-year forecast dealing with the free world's oil industry, but it is an optimism tempered by some moderation.

In its annual study of the oil business published last week, Chase Manhattan Bank says oil and gas will furnish 66% of the energy used by the free world in 1970. But what the bank calls "political invasion of the province of competitive enterprise"—some of it brought on by the industry itself—could hamper the ability of oil to supply the world with the low-cost energy it will need.

Here are some of the salient points of the report:

Total free world energy consumption will increase 50% in the next 10 years, with both oil and gas continuing to grow at the expense of other sources of energy.

Oil use will increase 73% in the next decade, but natural-gas growth will double. On this point, the bank relies heavily on expected growth of natural gas at the expense of oil in U. S. markets. The report concedes that its estimates for natural-gas growth in the free world outside the U. S. hinge on solutions to the problems of moving gas from remote productive areas to the ripe markets of western Europe.

125 billion barrels of oil will be consumed by the free world in the next 10 years—compared with 75 billion in the last decade, one of the most spectacular growth periods in the history of the industry.

$140 billion in capital expenditures will be necessary on the part of the industry to develop, produce, and distribute that amount of oil to the free world. Not all of the capital will be generated by the industry.

The bank's study considers the U. S. domestic industry separately as well as a part of the free-world picture. Here are some of the points relative to the U. S. industry:

Total U. S. energy consumption during the next 10 years will be 37% higher than in the last decade.

Oil's annual growth, at the rate of 2.7%, ranks below the rate of total energy's growth for the first time. The bank estimates total energy will increase at a yearly rate of 3.6%.

Expected energy trends in next decade

Free-world energy market

	1960 (Per-cent of total)	1970 (Per-cent of total)	(Change)
Oil	43	46	3%
Natural gas	15	30	5%
Coal	34	26	–8%
Water, nuclear power	8	8	0
Total energy	100	100	

U. S. hydrocarbon growth

	1960 (1,000-bbl.-daily oil equivalent)	1970 (1,000-bbl.-daily oil equivalent)	(Growth rate) (%/year)
Oil	9,700	12,600	2.7
Gas	6,100	10,600	5.7
All petroleum	15,800	23,200	4.0

Free-world hydrocarbon growth

	1960 (1,000-bbl.-daily oil equivalent)	1970 (1,000-bbl.-daily oil equivalent)	(Growth rate) (%/year)
Oil	9,300	16,800	6.1
Gas	700	2,750	14.3
All petroleum	10,000	19,550	7.0

Source: Chase Manhattan Bank.

Natural gas will grow at a 5.7% annual rate, taking more and more of oil's markets in industrial uses, in space heating (and cooling), and in the production of electric power. This leaves only transportation of the four major energy markets in which oil can expand at a greater rate than gas.

Factors of moderation. In spite of these general growth figures for the oil and gas industry, the bank finds cause for concern in a number of trends within the industry, both in the U. S. and abroad.

The study calls attention to oil's "two converging pressures"—increasing competition and more governmental intervention at all levels.

"It can live with competition, indeed thrive on it, if it is sufficiently free of government restraint to respond to economic laws," the bank believes.

"But, if it is not, a situation is created which is potentially harmful to the industry—and to all those it serves, governments included."

The biggest danger seen by the bank is the trend on the part of government everywhere to take more money from the business. This impairs the ability of the oil industry to grow. If governments or anyone else takes too large a share of this money, there is less money for the business to grow and the consumer is the one who ultimately suffers.

Pointing up the need for an adequate return to generate the capital needed to supply that 125 billion barrels of oil, the bank cites the fact that in the past 10 years the industry spent more money than it made.

According to Chase Manhattan, a major segment of the oil industry generated $54 billion over the last decade, but spent $60 billion.

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Mattei, oil's gadfly, can't be ignored

Oil men who regard ENI boss as flamboyant headline hunter are making a mistake. He's gaining ground in his deals, moving toward his big aim: Cutting out private firms as middlemen between oil-producing and consuming nations.

Ray Gibson
Asst. International Editor

A ROCK can be heaved a long way from some spots in the Alps, and this idea may have occurred to Enrico Mattei when he signed one of his latest oil deals high in the Alps.

The rock won't stagger the oil industry, but it will be felt. Mattei's newly acquired pipeline right-of-way across Switzerland into southern Germany throws him into an all-out race with the world's big oil companies for a big market. It is not a new role for Mattei.

In an area of oil-industry turbulence, Italy's go-getting head of Ente Nazionale Idrocarburi still makes more smoke than fire. But there are good reasons why his operation with a yearly income of $563 million and a profit of $9.5 million attracts more attention than a company this size would ordinarily stir.

Never before has an anti-industry theorist, wheeling-dealing promoter, price-cutting newcomer, and politically powerful antagonist been wrapped up in the person of one man. If Mattei on the surface appears to be only the latest headline hunter, oil men should remember that in him the industry faces:

A man with $1 billion in assets, every lira of which is dedicated to knocking out the foreign oil industry as it exists today. Mattei not only wants to establish ENI among its competitors, he eventually wants to eliminate private companies as middlemen in favor of direct relations between governments of producing and consuming countries on oil supplies.

An able executive and vote-getting type of politician who forcefully strives to put his aims across, who can jump quickly at any political or economic opportunity.

Enrico Mattei
A man to reckon with.

The industry also faces:

National Italian interests that will make it harder for ENI to evolve into just another international oil company. This is because low-product prices are more desirable to Italy than a prosperous national company.

A ready-made vehicle for Russian crude sales in Europe.

1. Mattei's aims

In the few years since Mattei became internationally famous with his 75-25 concession agreement in Iran—which has yet to put its first penny in the Iranian treasury—it has become clear that Mattei is far different from the usual outsider bidding high to win promising acreage.

Mattei believes, and never misses an opportunity to say so, that he is setting the stage for a new day when private companies will no longer function as integrated operations that produce and supply oil to the free world. He repeatedly declares he considers ENI's foreign agreements the first step toward direct relationships between oil-producing and consuming countries. The fact is secondary that he also is seeking entry into promising oil regions.

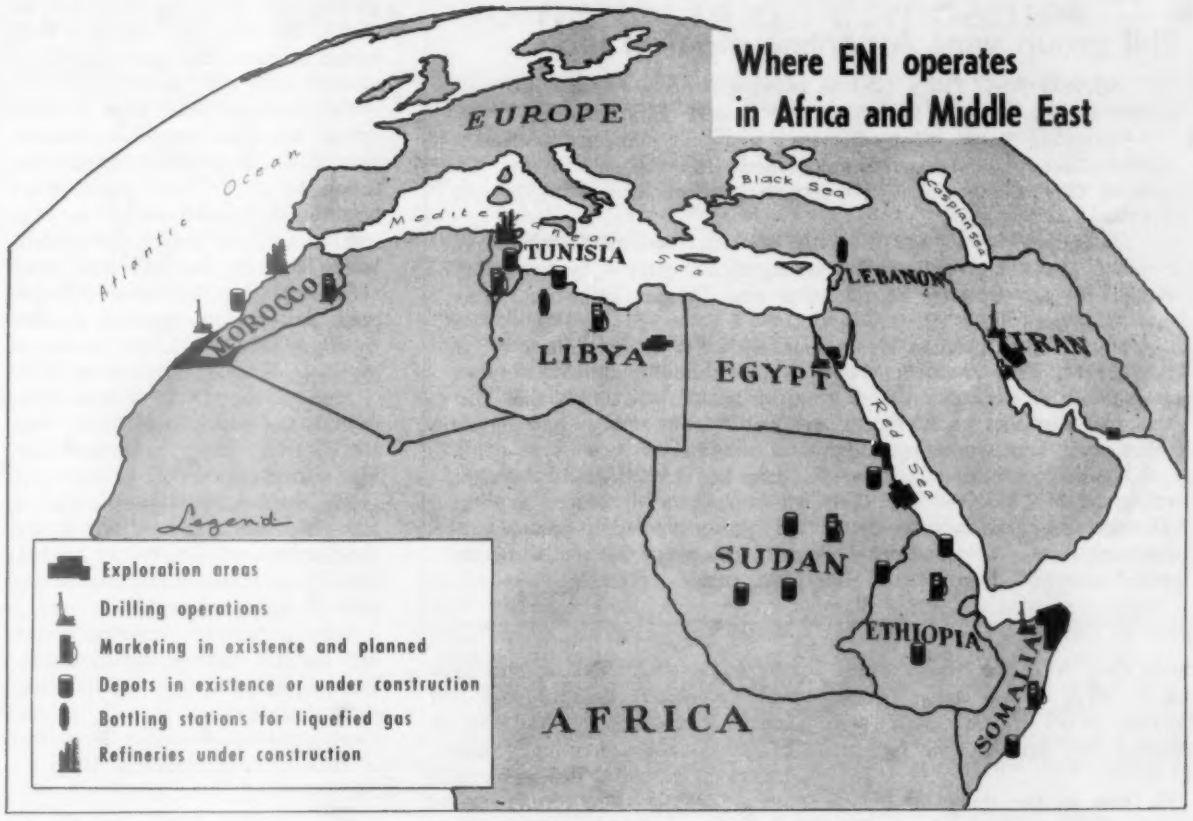
He preaches a gospel that mutually suitable agreements between private companies and governments will be more and more difficult to reach, and that the door is opening for a "new system" based on direct agreements between consumer and producer countries.

Mattei, who is four-square for high revenues for Arab countries when he talks to Arabs, is an equally staunch supporter for low-product prices when he talks to European consumers. He correlates these opposing views with the explanation that by eliminating alleged excess profits, and by means of controlled growth in markets, there will be no problem. Expanding markets, he explains, will enable Arab revenues to increase as the price per barrel decreases.

Mattei in action. Oil men, familiar with the need to spread exploration risks, with investment requirements to develop oil fields and markets, and a myriad of other problems, can brush off Mattei's ideas.

But the people he talks to are seldom oil men, and he gives his sales pitch in every place he negotiates. More and more countries are deciding it is worthwhile to make deals with him.

Besides his concessions in Iran where he has a 3,500-bbl., shut-in discovery in the Persian Gulf, and a share of crude production in Egypt, Mattei is building refineries in Morocco and Tunisia. He is drilling wells in Argentina, where he has submitted a low bid for a major pipeline system. He is already building a major pipeline in India, where



he recently extended a $100-million credit for the purchase of Italian-made equipment. (OGJ, Sept. 4, p. 113.)

His marketing organization is expanding in Europe and Africa, and he has won exploration rights in Libya, Morocco, Somalia, Sudan, and Tunisia, in addition to his Iranian and Egyptian agreements.

One of the biggest feathers in Mattei's cap is the new pact, signed at Chur, Switzerland, that gives ENI right-of-way across Switzerland for its pipeline into Bavaria. Mattei has already set up a marketing company in southern Germany, and the race is now on between his system and an extension of the Marseille-Karlsruhe system to be built into the same area by private companies.

ENI also is the largest importer of Russian crude in Europe. These cheap supplies, coupled with a protected income from gas sales in the Po Valley, make the state agency a formidable factor in the Italian marketing struggle. Competition for markets in Italy this year brought the retail price of gasoline at the pump, less taxes, down to 15.9 cents per gallon—the lowest in Europe.

In line with his feud with private companies, Mattei is seeking to dissolve ANIC, a refining company jointly held with Jersey Standard, which operates a 49,000-bbl. plant at Bari, and a 47,000-bbl. plant at Leghorn.

Abroad, Mattei leaps into the thick of disputes that most oil men wouldn't touch with a 10-ft. pole. When Iraq threatened nationalization of Iraq Petroleum Co., ENI dickered with Premier Kassim for the supply of 500 Italian technicians to keep the industry running. Despite denials, most circles in Europe believe it was only a move by the Italian cabinet which brought an end to the talks.

Mattei also was charged with offering technical aid to Algerian Nationalists for the operation of oil facilities in the French Sahara. This led to an assassination threat by French extremists, who in another plot failed to kill President De Gaulle.

Mattei has tried to turn the plot to his advantage. In a full-page advertisement carried recently in Cairo newspapers, which denied that ENI planned to sell fuel oil to Israel, mention was made of the assassination plot. The advertisement did not blame the plot on companies outright, but charged the attempt was planned because of Mattei's conflict with "imperialistic countries" over their policy toward Arab oil states.

An example of Mattei's adroitness in catering to both Arabs and Europeans was his explanation of ENI's role in the world-wide crude cuts last summer. ENI did not start the price cuts, he said, but was the first to pass them along to consumers.

2. Mattei—the man

If the ENI leader deports himself with the skill of a successful politician, he comes by his ability naturally. The 55-year-old leader came up the hard way through the ranks, but in a world that would appear completely strange to most self-made Americans.

The son of a policeman and a native of Pesaro Province, a region proud of its rugged individualists, Mattei started his career as a laborer. He founded a factory that produced chemicals for the textile and tanning industries while still a

ENI group wins Argentine pipeline job

ENRICO MATTEI'S ENI is proving itself a formidable competitor in the Western, as well as the Eastern Hemisphere.

An Italian group led by the state agency is expected to sign a $240-million pipeline-construction contract this month with the Argentine Government for a gas-carrying system from Patagonia to Buenos Aires.

The group's offer was the only one accepted after Argentina's Finance Ministry said financing arrangements offered by two other bidders, Texas Eastern Transmission and Dresser Industries, were unsatisfactory.

The winning participants include SAIPEM, a subsidiary of an ENI-AGIP, Fiat, Magnelli Marelli, Ercole Marelli, and Siderexport, an affiliate of Finsider, a steel group. Finsider will supply the pipe. Fiat and Pignone, an ENI company, will supply a large part of the other equipment, including compressor stations.

The project will be built over 8 years. But SAIPEM will deliver a minimum of 175,000 M.c.f. daily within 2 years of contract signing. The winning financial offer by the ENI group reportedly specifies repayment over a 15-year period. Annual interest of 8% will be computed monthly. There is a 3-year grace period.

young man. After the Italian armistice in 1943, he was active in the Partisan movement and was awarded the Bronze Star by the U. S.

He was in the thick of Italy's postwar rough and tumble politics, and popped up as a civil servant appointed to liquidate a listless oil-exploration agency carried over from the days of Mussolini. Instead of winding up the agency's affairs, however, he plunged into exploration in the Po Valley. Gas discoveries there were the basis of his empire. But he stayed close to politics, and was elected to the Italian Chamber of Deputies in 1948.

His agency was recreated at ENI in 1953, with assorted other state oil-related activities tossed into the pot. It was given autonomy, authority to operate in Italy and abroad, and a monopoly over the gas business in the Po Valley.

Mattei was appointed chairman for the first of several consecutive 3-year periods. He quickly reorganized his assets into five companies that own or control a flock of subsidiaries engaged in all branches of the oil industry, including petrochemicals and equipment manufacturing.

Mattei's highly personal grievance with international companies took shape in 1954 when ENI was left out of the consortium group of companies which reopened the Iranian oil industry after a 3-year shutdown. But ENI at the same time marketed only 30,000 bbl. daily (all of it in Italy), had little exploration or production experience except in gas, and did not qualify as a company that could absorb greatly expanding amounts of Iranian crude within its marketing setup.

Since then Mattei has accused the internationals, which he dubs "the Seven Sisters," of discriminating against him and of putting pressure on governments whenever he fails to complete a deal. Companies contend they simply are making better long-term offers on a strictly competitive basis.

While ENI recently pulled a coup with a refinery agreement in Ghana, other African governments have lately shied away from its offers. One reason is that Mattei asks for a favored position, and many governments still see the advantages of having a number of competitive sources for their oil supplies.

3. Mattei's power

Mattei by and large runs his show the way he sees fit, and is personally one of the most powerful men in Italy.

ENI's balance sheet has few details, and the government itself is in the dark about its finances. Mattei is a big contributor to the Christian Democratic Party, and ENI controls a major newspaper in Milan. The paper invariably supports ENI, but sometimes criticizes the government. This has led critics to charge that ENI not only is a state within a state, but state against a state.

Despite opponents, there is widespread belief in Italy that Mattei's policies fit the country's national interests to a "T." Italy needs markets for its manufactured products and it sees no danger in present levels of crude imported from Russia as payment. The Italian Government has, in fact, stymied a move by other Common Market nations to agree on limiting soviet imports.

Perhaps the key to Mattei, however, is the widely held theory that there are two groups in Europe staging a battle over oil prices. One group, so the theory goes, wants to key oil prices at a level which will enable the coal industry to survive. The other group wants the lowest cost oil supplies possible.

Italy, without major coal supplies, fell by the wayside as Germany, France, and England—all of them with coal—became great powers. Coal is taking a beating today, but it still supplies half of Europe's over-all energy needs.

On the other hand, none of the major European countries has major domestic oil supplies.

Italy lies closest to the great oil fields, however. And many Italians believe their country's gains in economic power depend on how far Mattei & Co. can pull the price from under coal.

Mexican oil agency's income and capital investments are up

PEMEX' gross income during the fiscal year ending August 31 was $503 million, up 15.3% over the preceding year.

President Lopez Mateos told the Mexican Congress that Pemex in the preceding 12 months made capital investments of $231 million in the nationalized oil industry, up $102 million. Current taxes totaled $58 million.

Production of crude and other liquids averaged 308,800 bbl. daily, while gas production was estimated at 10.1 billion cubic meters, or about 978 million cubic feet daily. Eight new field discoveries were made, and 730 wells were drilled.

Pakistan creates two national oil companies

PAKISTAN is going into the oil business, with plans to start exploration work immediately and marketing operations in a matter of months.

Two companies have been set up so far—Oil and Gas Exploration Corp., and Pakistan National Oils Ltd. The relationship between the two has not been made clear, but each is a 100%-Pakistani company, wholly owned or controlled by the government.

Oil and Gas Exploration Corp. was created by presidential decree in a move that coincided with the arrival of an advance party of Russian technicians. The Russians will direct a $35-million exploration program. This program is being equipped and financed by the soviets in behalf of Pakistan.

The Russian party, headed by A. A. Kaljajnov, is working out a schedule of operations while awaiting the arrival of more technicians.

A fund of $10.5 million has been authorized for Oil and Gas Exploration Corp., of which $2.1 million will be subscribed immediately. The balance will be supplied by the government in installments. The firm will be run initially by a three-man board headed by M. H. Zuberi, Secretary of Fuel, Power, and Natural Resources.

Marketing goals. The other company, Pakistani National Oils, plans to start marketing operations by April 1962. Abdul Jalil, managing director, said his firm will initially sell high-speed-diesel fuel, fuel oil, and kerosine. Gasoline will not be marketed immediately, but may be sold later.

Jalil indicates his company will buy cut-rate products offered by some countries and independent companies at prices below those posted by major companies. He says oil imports now cost the country between $63 and $73 million a year, and that his firm will save $6 to $8 million a year in foreign exchange.

Jalil also estimates that if his company is permitted to set up its own lubricating-oil plant, it will be able to cut the price of lubricants in half.

Pakistani sources hold 40% interest in a 30,000-bbl. refinery under construction at Karachi. Caltex, Stanvac, Shell, and Burmah Oil hold 60%. Jalil predicts that on top of the output from the new refinery, substantial amounts of product imports will be required to satisfy local demand, and that Pakistan National Oils is aiming at this market.

The company will have authorized capitalization of $4.2 million, and paid-up capital of $2.1 million.

Ironically, Pakistan's move toward state-run enterprise comes at a time when gas, found by a Burmah Oil subsidiary, is supplying greatly expanding amounts of local energy needs. Local oil and gas production last year supplied 30% of the country's hydrocarbon requirements. Sui gas alone was equivalent to 22.7% of inland consumption of products.

India forces another cut in product prices

INDIA has ordered the third cut in product prices in 3 years. This time it will cost companies $31.5 million a year.

K. D. Malaviya, Minister of Mines and Fuel, said the ruling will reduce the landed cost of product imports by $10.5 million in 1962. Revised discounts will reduce income of companies by another $14.7 million. Lower distribution charges and profits will cost a further $6.3 million.

The move follows governmental action that cut the country's annual oil bill by $18.9 million a year in 1958. Ad hoc agreements signed in November 1959 cost companies another $14.7 million a year. These expired September 30. The new ruling took effect October 1. Firms affected by the move are Burmah-Shell, Stanvac, and Caltex.

Lower prices will not be passed along to Indian consumers. New excise taxes will offset the price reductions, and the Indian treasury will pocket the difference.

Malaviya said he hoped private companies would fall in line with the new ruling. He said it was not necessary to give marketers time to consider the ruling.

Malaviya gave two reasons for not passing the price reductions along to consumers. One is that increased revenue will provide more funds for the government's oil-development program during the third 5-year period. The other is the government's intention to discourage too rapid growth in demand.

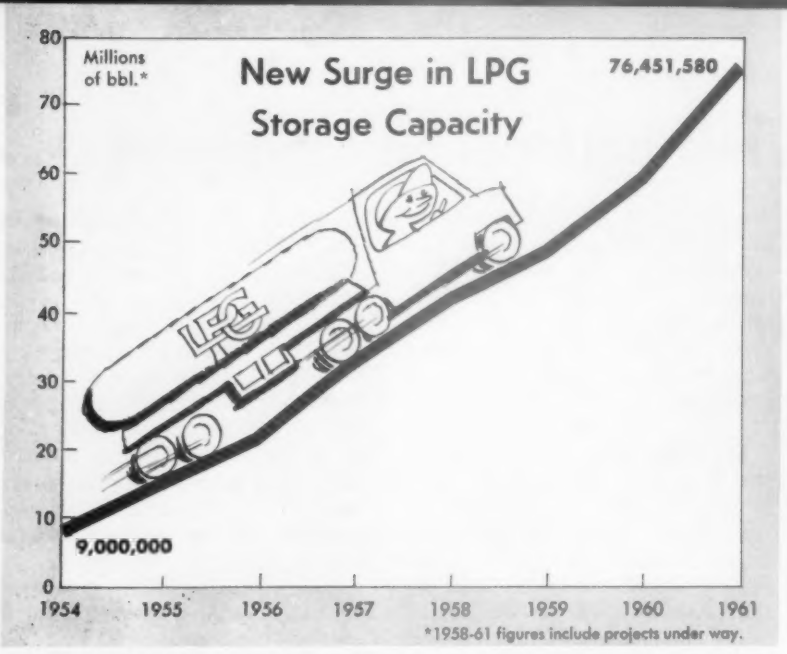
If companies do not fall in line, they will be subject to government retaliation through existing statutes. New Delhi sources say that while government is publicly threatening with a stick, it may be privately urging with a carrot by hinting expansion of private refineries will be permitted if companies accept the ruling without a fuss. On the other hand, if the cuts are accepted, marketers will be under pressure for similar cuts in Pakistan, Ceylon, and Burma.

The government's move is in line with recommendations made by a price-study committee. Companies knew the study was in the mill, but the timing and terms of the ruling hit marketers by surprise.

Among the suggestions accepted by the government were enforced discounts of 10% of the f.o.b. price of kerosine, aviation fuel, and high-speed diesel fuel, 5% on gasoline, 9.3% on light diesel oil, and 3% on furnace oil.

The committee suggested the new prices remain in force until 1965. But Malaviya, hopeful that world prices will weaken further, said they will be in effect for 2 years.

India has also forced down the price of crude imports, and was a key factor in Middle East price cuts last year. This resulted when private refiners refused an Indian request to process Russian crude, but soon after agreed to cut the price of imports from the Middle East. This in turn helped precipitate the general price cut.



SIGN OF THE TIMES in the booming LPG business is this persistent expansion in underground storage facilities. Capacity is spreading to new states, and older storage states are adding new space.

A new Journal report shows the nation's

LPG underground storage capacity

Increased production and LPG sales spur further underground storage. Industry has completed 14 new caverns the past 6 months, and another 18 are now under way. A record inventory has built up this summer, awaiting winter's tug.

BY ROBERT B. BIZAL
Director, Editorial Research

THE INDUSTRY continues to pour millions of dollars annually into the development of new underground storage capacity for LPG in the U. S.

The Oil and Gas Journal's eighth annual survey shows existing capacity has climbed to 67,428,960 bbl.

Add to this another 9,022,620 bbl. of new capacity currently being leached or dug out of the ground, and you have a total of 76,451,580 bbl., or about 25% higher than the comparable figure last year.

Just 7 years ago there was room for only about 9,000,000 bbl. of LPG in underground caverns.

Like the rapidly expanding LPG market itself, the storage picture is changing in a big way.

Three states have been added to the list of those with underground storage—Minnesota, Virginia, and Indiana. Still in the planning stage are caverns in Georgia and Iowa, which would also be the first for those states.

Texas, with its abundance of salt formations, is still, by far, the biggest storage state, with capacity of 48,622,520 bbl., counting projects now under way.

Kansas, also blessed with salt formations, is moving ahead rapidly and is overtaking Louisiana as the No. 2 LPG storage state. Capacity will soon reach 7,370,000 bbl., with a good portion of this growth the result of Northern Gas Products Co.'s huge new gas-processing plant as well as Mid-America Pipeline Co.'s new system.

Where salt domes or layers are nonexistent, the pipeline, utility, and refining companies are continuing to develop mined caverns in such formations as granite, limestone, and shale. A good example of this is in Ohio, where storage capacity has increased greatly.

For the first time a mined cavern is being created primarily in dolomite. This one is in Minnesota. Also for the first time, a mined cavern will be used for storage of propylene in Pennsylvania and Illi-

ONE OF THE LARGEST LPG STORAGE TERMINALS in the world is operated by Texas Eastern Transmission Corp. near Cincinnati, Ohio. Here workmen are installing a spray bar filling header in one of the mined caverns.

leaps 25%

nois, although salt caverns for propylene and ethylene are not uncommon.

Including projects currently under way, capacity in mined caverns now amounts to 7,020,620 bbl. This compares with only 5,464,800 bbl. last year. Bulk of such mining work is carried out by the specialized contractor, Fenix & Scisson, Inc., Tulsa.

Salt caverns now in existence or under development account for the major portion of the nation's total capacity—66,205,960 bbl.

Leaching of salt formations is the most popular in that it is a relatively inexpensive way to store LPG.

Why the Increase

Relatively cheap underground storage facilities have been a boon to the LPG market. Until recent years, LPG suppliers built up very small inventories during the summer months. Steel storage above ground was just too expensive.

Summer inventories have been climbing as new underground space has been made available. This year, inventories are at a much higher level than ever before, awaiting winter heating.

Figures tell the story

Existing LPG underground-storage capacity as of October 1961	67,428,960 bbl.
Capacity now under construction and due for completion in next 2 years	9,022,620 bbl.
U. S. total now in existence or under way	76,451,580 bbl.

Summer stock began building up early this year (OGJ, July 10, p. 62). As of September 1, LPG and LRG in underground storage was at 35,717,000 bbl. This compares with only 25,119,000 bbl. at the same time last year. Peak inventory usually occurs sometime during October.

Production at natural-gasoline and cycling plants was at an all-time high the first half of 1961, averaging about 986,000 bbl. per day, for a gain of about 6% over production rate the first half of 1960.

Sales of LPG and ethane were up 7% last year. And although domestic and commercial uses remain the largest market by volume, the chemical industry is the fastest growing market for LPG and ethane (OGJ, Sept. 11, p. 79).

Booming Pipelines

Tying in closely with the expanded production and sales is a burst of LPG-pipeline construction, which involves considerable storage.

Rounding out its first year of operation is the Mid-America pipeline system from the Southwest to the Upper Midwest. A new spur line is under construction in Iowa.

Northern Gas plans a 355-mile line from its giant gas-processing plant in Bushton, Kans., to Des Moines, where it would tie in with the Great Lakes Pipe Line Co., system.

LPG is "salted" away

Type of storage	Capacity in bbl.*
Salt domes and salt layers	66,205,960
Mined caverns (shale, granite, etc.)	7,020,620
Oil, gas, and water sands	3,225,000
U. S. total	76,451,580

*Includes caverns under way.

Dixie Pipeline Co. is building a 1,080-mile system across the South from near Houston to Raleigh, N. C. Another pipeline to span the southern states was proposed last year by Transcontinental Gas Pipe Line Corp.'s subsidiary, Trans-Southern Pipeline Corp. It would stretch from Texas to Virginia.

Still another major line is being built by Seadrift Pipe Line Corp. along the Texas coast.

More storage is being added on both ends of the Texas Eastern Transmission Corp.'s Little Big Inch which moves LPG from near Houston to Ohio. The company recently tied in with the Buckeye Pipe Line Co. system to extend Texas Eastern's distribution eastward.

New Storage Projects

The new Journal storage survey shows 35 LPG storage projects completed the past 6 months, currently under way, or proposed.

Those currently under way total 18 and involve more than 9,000,000 bbl. in capacity. Most are due for completion within a year.

Those proposed involve more than 4,000,000 bbl. This proposal capacity is not included in the total of the main company-by-company table on Page 87.

Following is a summary of some of the new projects:

Baltimore Gas & Electric Co. will complete its mined-granite storage in Baltimore County, Maryland, in spring 1962. Propane capacity will be 150,000 bbl.

Continental Oil Co. recently completed a $1,275,000 cavern at its Ponca City, Okla., refinery. The limestone cavern can hold 300,000 bbl. of propane. Scheduled for completion late spring 1962 is a 150,000-bbl. salt-layer cavern in Grant County, Oklahoma.

Dakota Salt & Chemical Co. has doubled its capacity in salt formation in Williams County, North Dakota, to 180,000 bbl. This is the world's deepest LPG cavern at about 8,500 ft. The leached-out facilities

have a dual purpose of storing LPG and providing material for a nearby salt-processing plant.

El Paso Natural Gas Co. is expanding salt-layer facilities in Lea County, New Mexico. A third cavern was recently completed, boosting capacity from 92,000 to 140,000 bbl. A fourth cavern, with capacity of 50,000 bbl., is due for completion December 1961.

Enterprise Petroleum Gas Co. completed washing a new 100,000-bbl. propane cavern from salt dome in Wood County, Texas, in August.

Goliad Corp.'s first LPG underground-storage facility is planned in Louisiana. The proposal calls for a salt-dome cavern with capacity of 3,000,000 bbl. Completion date is not known.

Gulf Oil Corp., parent company of Warren Petroleum Corp., filed application earlier this year with the Oklahoma Corporation Commission for a new storage cavern in Beaver County, Oklahoma. The new facility is now under construction at Warren's Mocane gas-processing plant. Completion date is not known.

Humble Oil & Refining Co. completed a 400,000-bbl. cavern for ethylene storage in Chambers County, Texas, in August. In July, Humble finaled a third gas-sand facility in Kleberg County. In Waller County, Humble abandoned a gas-sand facility which was used for butane. Still operating is a 1,000,000-bbl. facility for ethane and propane.

In Louisiana, Humble is leaching a 350,000-bbl. salt-dome cavern in Ascension Parish for butane storage.

Mid-America Pipeline Co. is adding three more storage caverns in Kansas and one in Texas. The company has been operating five in those two states since last winter when the new pipeline system went into operation.

The new Texas project, in Gaines County, will have capacity of 75,000 bbl. The three new ones in McPherson County, Kansas, will each have capacity of 50,000 bbl. Completion is scheduled December 1, 1961.

National Cooperative Refinery Association completed expansion at McPherson County, Kansas, early this month. The expansion involved 12 new caverns in salt layers with capacity of 600,000 bbl. of propane.

Northern Gas Products Co., a subsidiary of Northern Natural Gas Co. which has a huge new gas-processing plant near Bushton, Kans., is nearing completion of a giant storage project at Bushton, and plans another in Iowa.

The Bushton project has capacity of 1,500,000 bbl. in salt formation and is due for completion November 1, 1961. The company plans to build an LPG line to Des Moines, which would involve storage.

Phillips Petroleum Co. recently completed expansion of storage in salt domes in Brazoria County, Texas. Capacity was more than doubled when projects were completed last spring. The six caverns can now hold more than 3,700,000 bbl. of light hydrocarbons.

Pure Oil Co. has added 269,000 bbl. capacity to its salt-dome facilities in Texas. Completion of the propane storage project was in March 1961.

Seadrift Pipe Line Corp., a subsidiary of Union Carbide Chemicals Co., is developing two salt-dome projects in Matagorda County, Texas. One, with capacity of 200,000 bbl. of LPG, will be completed in December 1961, and the other, with capacity of 200,000 bbl. of ethylene, will go into operation in April 1962. The company is building a new products line in Texas.

Shell Oil Co. is due to complete its butane-storage facility in Ascension Parish, Louisiana, in 1962. Present capacity of the salt-dome cavern is 185,000 bbl., and capacity at completion will be 425,000 bbl.

Sinclair Oil & Gas Co. completed three salt-layer caverns in Reno County, Kansas, this summer, with total capacity of 160,000 bbl. of propane, and is under way at another in Lea County, New Mexico. The latter will have capacity of 50,000 bbl. of propane.

Solar Gas (Minnesota), Inc., affiliated with Signal Oil & Gas Co., is building the nation's first cavern which is primarily dolomite. Construction in dolomite is similar to limestone. The Solar project is in Polk County, northwestern Minnesota, and will be completed in spring 1962. Capacity will be 300,000 bbl. Also involved in the project is Amerada Petroleum Corp.

Standard Oil Co. (Ohio) has leached out a salt formation for LPG storage at its No. 1 refinery at Cleveland. The 80,000-bbl. project was put into operation first half of 1961.

Steelman Gas, Ltd., has increased capacity near Melville, Sask., from 180,000 to 312,000 bbl.

Sun Oil Co. is adding a fourth mined-granite cave at its Marcus Hook, Pa., refinery—this time for the storage of 75,000 bbl. of propylene.

The new propylene facility, scheduled for completion in spring 1962, will be the second such mined fa-

Storage Capacity by States

State—	Capacity in bbl.*
Alabama	365,000
California	600,000
Illinois	1,543,400
Indiana	175,000
Kansas	7,370,000
Kentucky	470,000
Louisiana	5,695,710
Maryland	150,000
Michigan	1,584,000
Minnesota	300,000
Mississippi	2,804,500
Montana	60,000
Nebraska	178,000
New Jersey	675,000
New Mexico	1,089,230
New York	920,000
North Dakota	180,000
Ohio	1,563,600
Oklahoma	783,000
Pennsylvania	975,000
Texas	48,622,520
Utah	100,000
Virginia	200,000
Wisconsin	47,620
Total in U. S.	76,451,580
Provinces—	
Alberta	450,000
Ontario	1,308,000
Saskatchewan	312,000
Total in Canada	2,070,000

*Includes projects under way.

Reprints Available

The Journal's eighth annual LPG storage survey will be available in reprint form at 50 cents each. Write Reader Service Department, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

What about LPG storage in Europe?

LPG underground storage in the Eastern Hemisphere is in its infancy, but the economics of this type of project is certain to be studied closely with growing supplies being made available in the Middle East.

Gulf Oil Corp. has started several underground storage projects at strategic marketing spots in Europe. Its move is tied to the construction of facilities to export 6,000 bbl. daily of refrigerated LPG from Kuwait.

Further supplies of LPG are being made available in neighboring Saudi Arabia, where Aramco has put on stream facilities to handle 4,000 bbl. daily of refrigerated propane and butane. The initial export shipment is expected this fall.

cility for propylene. This month Tuloma Gas Products Co. is completing a propylene facility at Wood River, Ill.

Texas Eastern Transmission Corp. is adding to capacity along its Little Big Inch line from Houston to Ohio. The company, which already has capacity to store 621,500 bbl. of propane and butane in mined shale in Butler County, Ohio, will complete new mined facilities there in December 1961. The new cave will have capacity of 425,000 bbl. for propane.

Scheduled for completion in January 1962 is a shale cavern in Gibson County, Indiana, with capacity of 175,000 bbl. for propane.

On the Houston end of the line, Texas Eastern, which already has a two-well salt-dome storage area in Chambers County with 2,750,000 bbl. capacity, is adding much more. Another 4,500,000 bbl. will be washed out by 1963. This program involves three new wells.

Texas Gulf Producing Co. completed its first salt-storage facility in August 1961. The new cavern, in Ector County, Texas, has capacity for 28,500 bbl. of natural-gas liquids.

Trans-Southern Pipeline Corp., subsidiary of Transcontinental Gas Pipe Line Corp., still has in planning stage a 1,000,000-bbl. mined granite storage facility near Atlanta, Ga. This is in conjunction with a planned products line from near Houston, Tex., to Danville, Va.

Tuloma Gas Products Co. was due to complete two new projects in October. In Madison County, Illinois, new limestone facilities will hold 180,000 bbl. of propane and 50,000 bbl. of propylene.

And at Hutchinson, Kans., the company has just completed another salt-bed cavern with capacity of 125,000 bbl. for propane and butane.

Union Light, Heat & Power Co. recently completed a mined limestone cavern for 180,000 bbl. of propane. The cavern is near Covington, Ky., just across the river from Cincinnati. Union is a subsidiary of Cincinnati Gas & Electric.

United Petroleum Gas Co. is due to complete its sandstone storage facility for propane in Pierce County, Wisconsin, January 1, 1962. Capacity will be 47,620 bbl.

Wanda Petroleum, Inc., completed a new salt-dome cavern in Harris County, Texas, in August. It has capacity for 100,000 bbl. of normal butane.

Washington Gas Light Co. is adding to its buried-tank capacity by building a 200,000-bbl. mined-granite storage area in Fairfax County, Virginia.

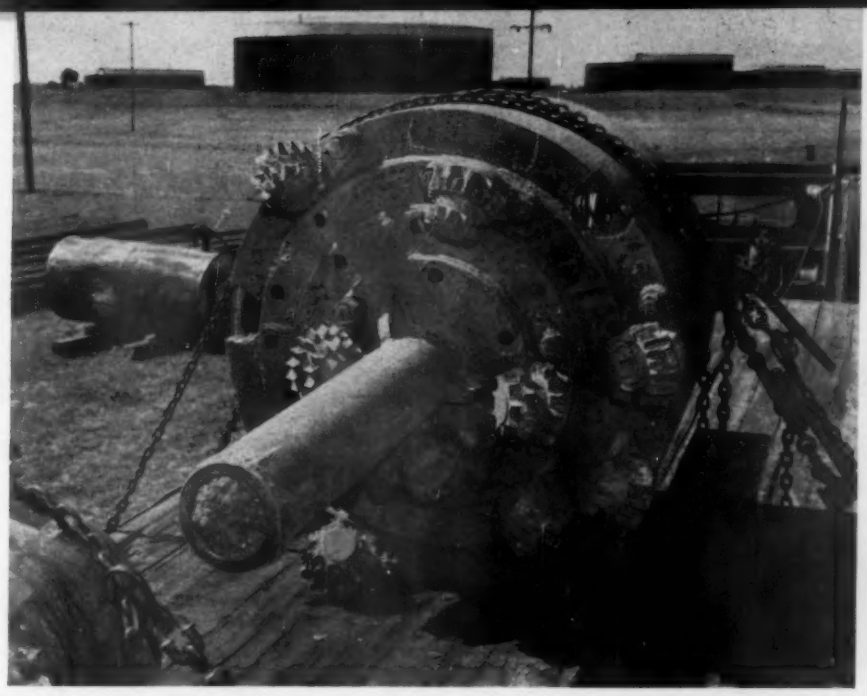
LPG underground storage facilities

★ The star symbol indicates projects recently completed, under way, or planned.

Company, County and type of storage	Capacity (in bbl.)	Product
Alabama		
Tuloma Gas Products Co.—Sinclair Oil & Gas Co.		
Marengo—Mined chalk	140,000	B-P mix
Marengo—Mined chalk	225,000	Propane
California		
Standard Oil Co. of California		
Los Angeles—Water sand	150,000	Propane
Los Angeles—Water sand	150,000	Butane
Los Angeles—Water sand	100,000	Propylene
Sunray Mid-Continent Oil Co.		
Los Angeles—Oil sand*	200,000	Propane
Georgia		
Trans-Southern Pipeline Corp. (subsidiary of Transcontinental Gas Pipe Line Corp.)		
★ Near Atlanta—Mined granite (proposed)†	(1,000,000)	LPG
Illinois		
Phillips Petroleum Co.		
Kankakee—Mined shale	260,000	Propane
Shell Oil Co.		
Madison—Mined limestone	520,000	Butane
Madison—Mined limestone	265,000	Propane
Tuloma Gas Products Co.		
★ Madison—Mined limestone (newly completed)	180,000	Propane
★ Madison—Mined limestone (newly completed)	50,000	Propylene
U. S. Industrial Chemicals Co.		
Douglas—Mined shale	170,000	Propane
Warren Petroleum Corp.		
Kane—Mined Shale	46,400	LPG
White—Mined shale	52,000	LPG
Indiana		
Texas Eastern Transmission Corp.		
★ Gibson—Mined shale (under construction)	175,000	Propane
Iowa		
Northern Gas Products Co. (subsidiary of Northern Natural Gas Co.)		
★ Near Des Moines, Iowa (planned)	Unknown	LPG

LPG UNDERGROUND STORAGE SURVEY (Continued)

Company, County and type of storage	Capacity (in bbl.)	Product
Kansas		
Cities Service Oil Co.		
Reno—Salt layer (4 caverns)	239,000	Butane
Reno—Salt layer (10 caverns)	694,000	Propane
Mid-America Pipe Line Co.		
McPherson—Salt layer (3 caverns)	210,000	Propane
★ McPherson—Salt layer (under construction)	50,000	Propane
★ McPherson—Salt layer (under construction)	50,000	Isobutane
★ McPherson—Salt layer (under construction)	50,000	Butane
National Cooperative Refinery Association		
McPherson—Salt layer (8 caverns)	400,000	Propane
McPherson—Salt layer (10 caverns)	500,000	Butane
★ McPherson—Salt layer (12 newly completed caverns)	600,000	Propane
Northern Gas Products Co. (subsidiary of Northern Natural Gas Co.)		
★ Ellsworth—Salt formation (under construction)	1,500,000	Propane, butanes
Pan American Petroleum Corp.		
Grant—Salt layer (7 caverns)	175,000	LPG
Phillips Petroleum Co.		
Kingman—Salt layer (6 caverns)	417,000	Butane, propane
Security Underground Storage Co.		
McPherson—Salt bed	1,200,000	Propane
★ McPherson—Salt bed (newly completed)	150,000	Propane
Sinclair Oil & Gas Co.		
★ Reno—Salt layer (3 newly completed caverns)	160,000	Propane
Skelly Oil Co.		
McPherson—Salt layer	500,000	Propane
Tuloma Gas Products Co.		
Reno—Salt bed	350,000	Propane, butane
★ Reno—Salt bed (newly completed)	125,000	Propane, butane
Kentucky		
Columbia Hydrocarbon Corp.		
Greenup—Mined cavern	210,000	Propane
Greenup—Mined cavern	80,000	Butane
Union Light, Heat & Power Co. (subsidiary of Cincinnati Gas & Electric Co.)		
★ Kenton—Mined limestone (newly completed)	180,000	Propane
Louisiana		
Cities Service Refining Corp.		
Cameron—Salt dome	600,000	Butane
Cameron—Salt dome	750,000	Propane
Continental Oil Co.		
Evangeline—Salt dome	90,000	B-P mix
Evangeline—Salt dome	142,000	Propane
Evangeline—Salt dome	130,000	Butane
Dow Chemical Co.		
Plaquemine—Salt dome (capacity not reported)		Ethylene, LPG
General Gas Corp.		
Bienville—Salt Dome	238,000	Propane
Bienville—Salt dome	100,000	B-P mix
Goliad Corp.		
★ Salt dome in Louisiana (planned)†	(3,000,000)	LPG
Humble Oil & Refining Co.		
Ascension—Salt dome (2 caverns)	425,000	Butane
Ascension—Salt dome	210,000	Isobutane
Ascension—Salt dome	345,000	Propane
Ascension—Salt dome	500,000	Ethylene
★ Ascension—Salt dome (now leaching)	350,000	Butane
Runnels Gas Products Corp.		
Calcasieu Parish—Salt dome	600,000	Ethylene
Calcasieu Parish—Salt dome	100,000	Propane
Shell Oil Co.		
★ Ascension—Salt dome (under construction)	425,000	Butane
Tuloma Gas Products Co.		
Bienville—Salt dome	150,000	Propane, butane
Warren Petroleum Corp.		
Bienville—Salt dome	385,710	LPG
St. Landry—Salt dome	155,000	LPG
Maryland		
Baltimore Gas & Electric Co.		
★ Baltimore—Mined granite (under construction)	150,000	Propane
Michigan		
Aurora Gasoline Co.		
Wayne—Salt bed	150,000	Propane
Wayne—Salt bed	150,000	Butane
Cities Service Oil Co.		
Kent—Salt layer (4 caverns)	640,000	Propane
Dow Chemical Co.		
Midland—Salt layer (capacity not reported)		Ethylene, propylene
Skelly Oil Co.		
Kent—Salt layer	190,000	Propane
Sun Oil Co.		
Wayne—Salt layer (3 caverns)	266,000	Propane
Wayne—Salt layer (2 caverns)	188,000	Butane
Minnesota		
Solar Gas (Minnesota), Inc. (affiliated with Signal Oil & Gas Co.)		
★ Polk—Mined dolomite (under construction)	300,000	LPG
Mississippi		
General Gas Corp.		
Forrest—Salt dome	35,700	Propane
Mobil Oil Co. (acquired from Anchor Petroleum Co.)		
Forrest—Salt dome (2 caverns)	600,000	Propane
Forrest—Salt dome	325,000	LPG
Union Texas Natural Gas Corp. (acquired from Skelly Oil Co.)		
Forrest—Salt dome	240,000	Propane
Forrest—Salt dome	80,000	Butane
Warren Petroleum Corp.		
Forrest—Salt dome	1,523,800	LPG
Montana		
Union Texas Natural Gas Corp.		
Wibaux County—Salt layer	60,000	Propane
Nebraska		
Metropolitan Utilities District of Omaha		
Douglas—Mined shale	178,000	Propane
New Jersey		
Humble Oil & Refining Co.		
Union—Mined shale	300,000	Propane
Union—Mined shale	375,000	Butane
New Mexico		
Arrow Gas Co.		
Eddy—Salt layer (3 caverns)	106,000	LPG
Atlantic Refining Co.		
Lea—Salt layer	50,000	Butane
Lea—Salt layer	70,000	Propane
El Paso Natural Gas Co.		
Lea—Salt layer (3 caverns)	140,000	LPG
★ Lea—Salt layer (1 cavern under construction)	50,000	LPG
Sinclair Oil & Gas Co.		
★ Lea—Salt layer (under construction)	50,000	Propane
Skelly Oil Co.		
Lea—Salt layer	150,000	Propane
Lea—Salt layer	80,000	Butane
Warren Petroleum Corp.		
Lea—Salt layer	202,380	LPG
Lea—Salt layer	190,850	LPG



THIS GIANT BIT was used by Fenix & Scisson, Inc., to drill a 52-in. shaft for a cavern completed last spring at Continental Oil Co.'s Ponca City, Okla., refinery. Workers and equipment descended the hole and began digging horizontally in limestone about 350 ft. below the surface to make room for 300,000 bbl. of propane.

Company, County and type of storage	Capacity (in bbl.)	Product
New York		
Mobil Oil Co. (acquired from Anchor Petroleum Co.)		
Steuben—Salt bed (4 caverns)	440,000	Propane
Steuben—Salt bed (2 caverns)	180,000	Butane
Suburban Propane Gas Corp.		
Cortland—Salt layer	300,000	Propane
North Dakota		
Dakota Salt & Chemical Co.		
Williams—Salt cavern	180,000	Propane, butane
Ohio		
Ashland Oil & Refining Co.		
Canton area—Salt formation	Unknown	Unknown
Cincinnati Gas & Electric Co.		
Butler—Mined shale	186,200	Propane
Dayton Power & Light Co.		
Butler—Mined shale	190,900	Propane
Standard Oil Co. (Ohio)		
Allen—Mined shale (2 caverns)	60,000	Propane
★ Cuyahoga—Salt formation (newly completed)	80,000	LPG
Texas Eastern Transmission Corp.		
Butler—Mined shale	621,500	Propane, butane
★ Butler—Mined shale (under construction)	425,000	Propane
Oklahoma		
Continental Oil Co.		
★ Grant—Salt layer (under construction)	150,000	Butane
★ Kay—Mined limestone (newly completed)	300,000	Propane
Gulf Oil Corp.		
★ Beaver—Salt formation (project at Warren Petroleum's gas-processing plant is under construction)		LPG
Humble Oil & Refining Co.		
Pontotoc—Abd. oil wells	175,000	LPG
Shell Oil Co.		
Beckham—Salt layer	15,000	Propane
Sinclair Oil & Gas Co.		
Seminole—Mined shale	110,000	Propane
Texaco Inc.		
Beaver—Salt layer	33,000	Propane
Pennsylvania		
Sun Oil Co.		
Delaware—Mined granite (2 caverns)	500,000	Butane
Delaware—Mined granite	400,000	Propane
★ Delaware—Mined granite (under construction)	75,000	Propylene

Company, County and type of storage	Capacity (in bbl.)	Product
Texas		
Anchor Petroleum Co. (see Mobil listings)		
Cities Service Oil Co.		
Cochran—Salt layer	20,000	Propane
Cochran—Salt layer	14,000	Butane
Gray—Salt layer (3 caverns)	345,000	Propane
Gray—Salt layer	120,000	Butane
Cities Service Production Co.		
Midland—Salt layer	50,000	LPG
Continental Oil Co.		
Reagan—Salt layer	46,000	Propane
Cosden Petroleum Corp.		
Howard—Salt layer	50,000	Alky. feed
Howard—Salt layer	(215,000)	Nat. gaso.†
Howard—Salt layer (2 caverns)	230,000	Propane
Dorchester Corp.		
Carson—Salt layer	80,000	Propane
Carson—Salt layer	35,000	Butane
Dow Chemical Co.		
Brazoria—Salt dome	‡500,000	Olefins, LPG
El Paso Natural Gas Co.		
Ector—Salt layer (4 caverns)	165,000	LPG
Midland—Salt layer (4 caverns)	250,000	LPG
Reagan—Salt layer (10 caverns)	820,000	LPG
Enterprise Petroleum Gas Co.		
Wood—Salt dome	100,000	Butane
Wood—Salt dome	200,000	Propane
★ Wood—Salt dome (newly completed)	100,000	Butane
Gulf Oil Corp.		
Howard—Salt layer	125,000	Nat.-gas liquids
Jefferson—Salt dome	510,000	LPG
Humble Oil & Refining Co.		
★ Chambers—Salt dome (newly completed)	400,000	Ethylene
★Kleberg—Gas sand (newly completed)	Unknown	Butane
Kleberg—Gas sand	Unknown	Propane
Kleberg—Gas sand	Unknown	Ethane
Waller—Gas sand	1,000,000	Ethane, propane
Waller—Gas sand (abandoned January 1961)		Butane
La Gloria Oil & Gas Co.		
Jim Wells—Sand	75,000	Butane
Jim Wells—Sand	100,000	Propane
Lion Oil Co.		
Scurry—Salt layer (6 wells)	495,000	Propane
Scurry—Salt layer (2 wells)	136,000	Butane
Liquigas Co.		
Freestone—Salt dome	281,000	Propane
Freestone—Salt dome	106,000	B-P mix

LPG UNDERGROUND STORAGE SURVEY (Continued)

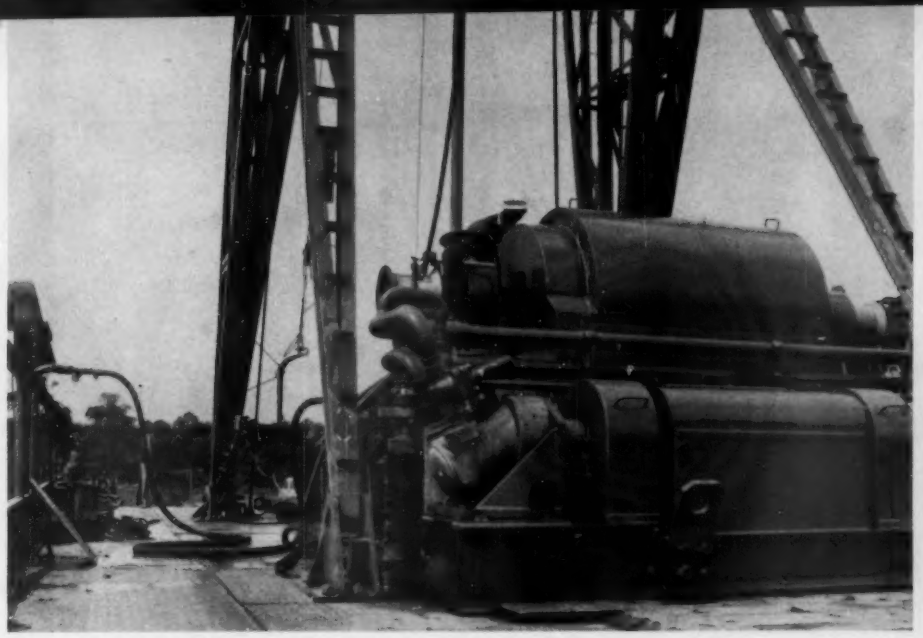
Company, County and type of storage	Capacity (in bbl.)	Product
Mid-America Pipeline Co.		
Gaines—Salt layer	100,000	Propane
Gaines—Salt layer	75,000	Isobutane
★ Gaines—Salt layer (under construction)	75,000	Butane
Mobil Oil Co.		
Liberty—Salt dome (2 caverns)	636,000	Propane
Liberty—Salt dome (2 caverns)	951,000	Butane
Liberty—Salt dome (2 caverns)	643,000	Isobutane
Liberty—Salt dome (1 cavern)	312,000	LPG
Liberty—Salt dome (1 cavern)	222,000	Propylene
Liberty—Salt dome	752,000	Ethylene
Martin—Salt dome (5 caverns acquired from Anchor Petroleum)	350,000	Propane
Martin—Salt dome (1 cavern acquired from Anchor Petroleum)	50,000	LPG
Pan American Petroleum Corp.		
Andrews—Salt layer (4 caverns)	198,000	Propane
Ector—Salt layer (2 caverns)	178,000	Propane, butane
Hockley—Salt layer (4 caverns)	235,000	Propane, butane
Phillips Petroleum Co.		
★ Brazoria—Salt dome (6 caverns, including 4 new ones)	3,717,000	Light hydr.
Ector—Salt layer	(250,000)	De-ethanized gasoline†
Hutchinson—Salt layer (13 caverns)	4,080,000	Butane, propane
Reeves—Salt layer	65,000	Propane
Pure Oil Co.		
Andrews—Salt layer (3 caverns)	309,000	Propane
Jefferson—Salt dome	225,000	Butane
Jefferson—Salt dome	269,000	Propane
Reef Corp.		
Howard—Salt layer (5 caverns)	253,000	Propane
Howard—Salt layer	36,000	Butane
Seadrift Pipe Line Corp. (Union Carbide Chemicals Co.)		
★ Matagorda—Salt dome (under construction)	200,000	LPG
★ Matagorda—Salt dome (under construction)	200,000	Ethylene
Shamrock Oil & Gas Corp.		
Moore—Oil sand (this facility not in use)	1,190,000	
Moore—Salt cavity	300,000	Propane
Shell Oil Co.		
Ector—Salt layer	527,000	Butane
Ector—Salt layer	149,000	Propane
Yoakum—Salt layer (2 caverns)	727,000	Propane
Sid Richardson Gasoline Co.		
Winkler—Salt layer (3 caverns)	386,000	Propane
Winkler—Salt layer (brine well)	92,000	
Skelly Oil Co.		
Carson—Salt layer	390,000	Propane
Carson—Salt layer	120,000	Butane
Southern Minerals Corp.		
Nueces—Oil sand	85,000	B-P mix
Standard Oil Co. of Texas		
Scurry—Salt layer (4 caverns)	127,500	Propane
Scurry—Salt layer	26,600	Butane
Sunray Mid-Continent Oil Co.		
Scurry—Salt layer (3 caverns)	97,500	Propane
Scurry—Salt layer	16,850	Butane
Tenneco Oil Co. (Tennessee Gas Transmission Co.)		
Chambers—Salt dome (7 caverns)	2,350,000	Butane, propane
Texaco Inc.		
Hardin—Salt layer (4 caverns)	833,000	Butane
Scurry—Salt layer (4 caverns)	117,000	Propane
Texas Butadiene & Chemical Corp.		
Chambers—Salt dome (5 wells)	‡1,700,000	Nat.-gas liquids
Texas Eastern Transmission Corp.		
Chambers—Salt dome (2 wells)	2,750,000	Propane, butane
★ Chambers—Salt dome (3 wells under construction)	4,500,000	Propane, butane
Texas Eastman Co.		
Smith—Salt dome	400,000	Ethylene
Smith—Salt dome	240,000	Propylene
Smith—Salt dome	280,000	Propane
Texas Gulf Producing Co.		
★ Ector—Salt strata (newly completed)	28,500	Nat.-gas liquids
Tuloma Gas Products Co.		
Fort Bend—Salt dome	300,000	Butane
Union Texas Natural Gas Corp.		
Chambers County—Salt dome (3 caverns)	500,000	Butane
Glasscock County—Salt layer	150,000	Butane
Harris County—Salt dome (2 caverns)	650,000	Butane
Harris County—Salt dome	500,000	Propane
Upton County—Salt layer (4 caverns)	525,000	Propane
Upton County—Salt layer (3 caverns)	375,000	Butane
Wanda Petroleum, Inc.		
Harris—Salt dome	100,000	Butane
Harris—Salt dome	300,000	Propane
★ Harris—Salt dome (newly completed)	100,000	Butane
Warren Petroleum Corp.		
Chambers—Salt dome	5,858,600	Nat.-gas liquids
Crane—Salt layer	203,730	LPG
Smith—Salt dome	1,095,240	LPG
Stephens—Mined shale	48,000	LPG
Utah		
Suburban Gas		
Grand—Salt bed	100,000	Propane
Virginia		
Washington Gas Light Co.		
★ Fairfax—Mined granite (under construction)	200,000	Propane
Wisconsin		
United Petroleum Gas Co.		
★ Pierce—Mined and sealed sandstone (under construction)	47,620	Propane
TOTAL FOR U. S. §	**76,451,580**	

*Combination storage and miscible-phase displacement. †Not included in total. ‡As reported in 1959 survey. Data not available from company in 1961. §Includes existing capacity and projects currently under way.

Capacity in Canada

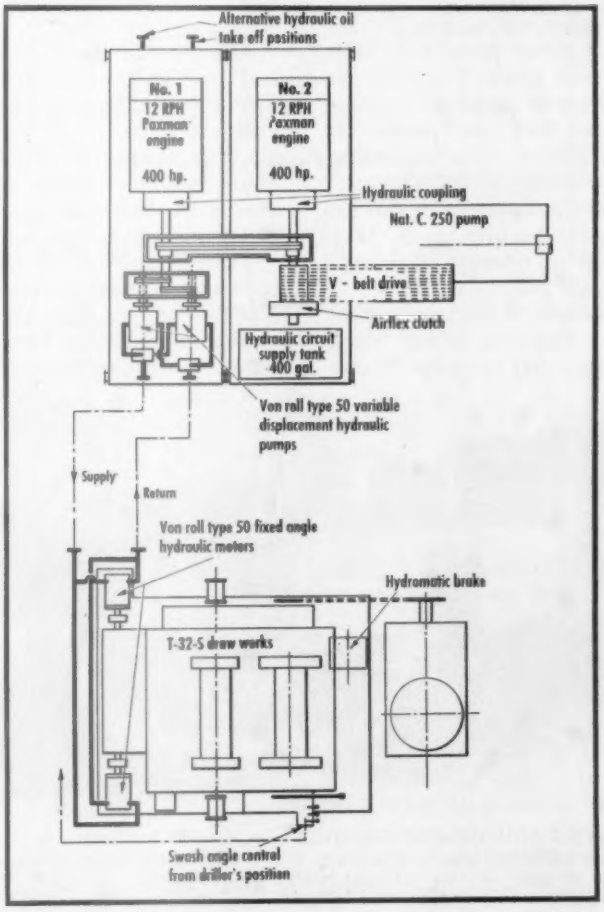
Company, County and type of storage	Capacity (in bbl.)	Product
Alberta		
Alberta Underground Storage Co. (owned by British American, Canadian Hydrocarbons, and Goliad)		
Hughenden—Salt formation (3 caverns)	450,000	Propane, butanes
Ontario		
Canadian Oil Companies, Ltd.		
Lambton—Salt dome	190,000	Butane
Dow Chemical Co.		
Sarnia area—Salt layer (capacity not reported)		LPG, P-P mix
Imperial Oil Ltd.		
Sarnia—Salt layer	100,000	LPG
Sarnia—Salt layer	100,000	Butane
Sarnia—Salt layer	100,000	Ethylene
Polymer Corp., Ltd.		
In salt beds (6 wells)	518,000	C_4 fraction
Sun Oil Co.		
Sarnia—Salt layer (3 caverns)	300,000	Butane
Saskatchewan		
Steelman Gas, Ltd.		
Melville—Salt layer (2 wells)	312,000	Propane
TOTAL FOR CANADA	**2,070,000**	

Big-horsepower hydraulic motors are being used for the first time to power an oil-well drilling-workover rig. Intended primarily for offshore wells in the Persian Gulf, the rig has two fluid motors driving the draw works and rotary table. Engines, hydraulic pumps, and mud pumps remain on a floating barge.



BARE SPACE BEHIND DRAW WORKS is where chain compound and engines would normally go. Angle hydraulic motor at center and similar one on other end of draw works supply power not only for hoisting but also for turning the rotary.

Hydraulic motors power draw works



WHAT IS probably the first large-size draw works ever to be powered by hydraulic motors is now drilling in England. On this unusual rig, two 200-hp. fluid motors drive a conventional National T-32-S rig.

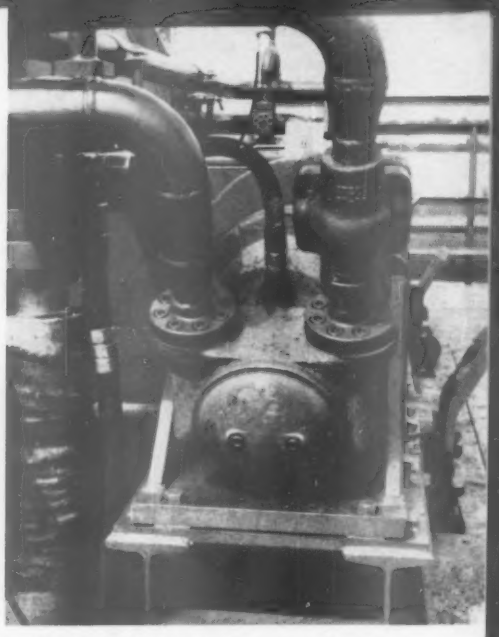
Chief reasons behind the hydraulic-motor design are these:

- It fills the need for a completely flameproof drive in the vicinity of the wellhead.
- It is packaged so that offshore wells can be worked over from a very small platform; engines and mud pumps can be left on a floating barge while only mast and draw works are hoisted onto the platform.

Responsible for the new design is Abu Dhabi Marine Areas, Ltd., an affiliate company of British Petroleum's BP Exploration Co. Currently, the hydraulic rig is being tested in drilling a number of 3,400 to 4,500-ft. wells in South Laverton field of Nottingham and Lin-

ENGINE POWER IS REMOTE from draw works as a result of using hydraulic power. Draw works needs no reverse gear since hydraulic system can be reversed; rotary table is chain driven off draw works. Hydraulic system has 400-gal. reserve and 250 in active system.

HYDRAULIC PUMPS, ENGINES are located at spot distant from the derrick floor. Thus, there is no explosion danger on derrick floor. Moreover, the engines and pumps can be left on a floating barge while the mast and draw works are placed on small offshore platform.



SMALL BUT POWERFUL hydraulic motor puts out 200 continuous hp. to draw works. Steel line and rotary hose carry hydraulic fluid.

coln. At the conclusion of testing, the entire layout will be sent to the Persian Gulf for duty in working over offshore wells in Abu Dhabi field.

BP's drilling branch has been working on hydraulic transmission for drilling equipment for some 3 years. And, for almost 2 years, the group has had a 200-hp. hydraulic drive in the field powering a mud pump. BP calculates the cost of the hydraulic - motor draw - works drive as competitive with ordinary mechanical drive. And, the hydraulic drive allows use of much smaller and cheaper offshore platforms.

Elsewhere, smaller hydraulic motors have been used for many years on drilling rigs for such drives as the shale shaker, water pump, and blowout-preventer accumulators. However, past attempts to drive larger equipment such as power swivels have been primarily on a rental or lease basis.

BP's engineers have selected higher-horsepower equipment which has proved successful and reliable in long use for aircraft-hydraulic systems. In addition, similar pumps and motors are used in oil refineries for such jobs as driving paddle mixers in catalyst-reactor vessels.

Two 400-hp. diesels. Prime movers for the BP rig are a pair of 400-hp. Daven-Paxman diesel engines. These are 1,250-r.p.m. models of the type previously used successfully for drilling rigs. The two engines are chain compounded together with clutch between. This arrangement allows either to do the work of the other when load is light or in an emergency. Or, both engines can be put on a single heavy load.

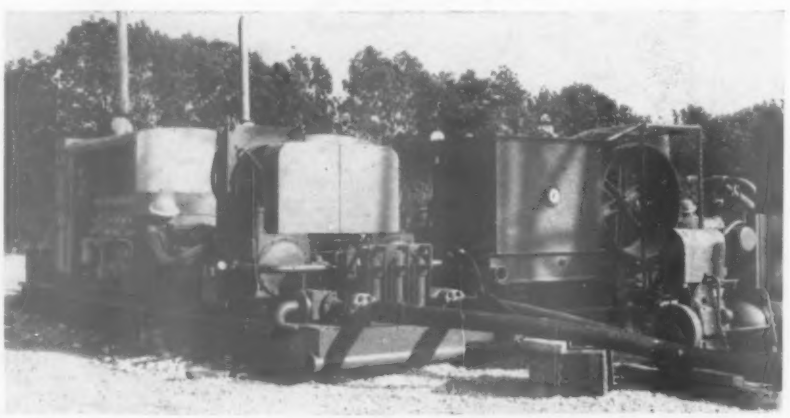
One engine skid carries a V-belt sheave for direct drive to the rig's 250-hp. mud pump. The other engine skid has two hydraulic pumps.

The two hydraulic pumps are Von Roll (Swiss) variable-displacement type rated for 200 hp. each. Maximum displacement of the two combined is 350 Imp. g.p.m. Maximum working pressure of the system is 3,500 psi.

Displacement of the pumps is not varied by changing motor speed; rather engine and pump run at constant speed. Pump output is varied by changing the angle of its "swash plate" between zero and 25°. Maximum output pressure goes up as volume goes down. Control of the pump angle is by hydraulic-control gear connected to a simple lever at the driller's position.

The hydraulic-fluid output is carried in high-pressure lines to the derrick floor. There, two fixed-angle hydraulic motors are attached to the draw works, one on either end of an input-power shaft. These fluid motors are Von Roll type rated at 200 continuous horsepower.

There is no need for any torque converter or fluid coupling in the draw works. In fact, there is, at maximum torque, a 2.84 multiplication of torque from hydraulic-



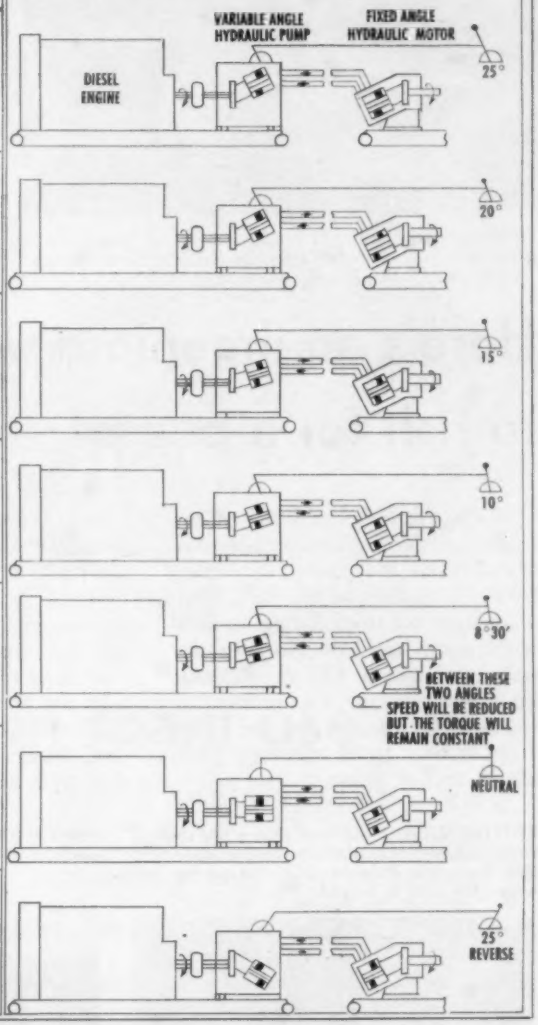
PRIME MOVERS COMPOUNDED TOGETHER provide 800 hp. total. Engine on left drives the two 200-hp. hydraulic pumps. Engine on right drives mud pump. Either engine can do work of other at light load or in emergency. Or, both can be put on a single load.

VARIABLE-SPEED VARIABLE-TORQUE HYDRAULIC DRIVE

	Diesel Engine Prime Mover			Hydraulic Pump				Hydraulic Motor			
Hydraulic-pump Angle	Horsepower	Speed, r.p.m.	Torque, ft.-lb.	Horsepower	Speed, r.p.m.	Displacement g.p.m.	Pressure psi.	Horsepower	Speed, r.p.m.	Torque, ft.-lb.	Motor Angle
25°	200	1,200	875	200	1,200	233	1,230	200	1,200	875	25°
20°	200	1,200	875	200	1,200	188	1,550	200	970	1,095	25°
15°	200	1,200	875	200	1,200	142	2,000	200	730	1,420	25°
10°	200	1,200	875	200	1,200	95	3,025	200	490	2,140	25°
				Torque multiplication=2.84 to 1							
8°30′	200	1,200	875	200	1,200	82	3,500	200	425	2,480	25°
				Maximum working pressure of hydraulic system							
0°	0	1,200	0	0	1,200	0	0	0	0	0	25°
				Diesel engine idling at full speed							
25° Reverse	200	1,200	875	200	1,200	233	1,230	200	1,200	875	25°
				Hydraulic motor runs in reverse							

HYDRAULIC DRIVE—PRINCIPLE OF OPERATION.

NOTES.
ALL FIGURES ARE CALCULATED AND FOR CLARITY NO ALLOWANCE HAS BEEN MADE FOR EFFICIENCIES.
ON TEST AVERAGE EFFICIENCY OF THE HYDRAULIC SYSTEM HAS BEEN ABOUT 88%.



VARYING PUMP ANGLE varies the volume and pressure of the output. Maximum volume is at maximum angle of 25°. Maximum torque (and pressure) is at 8½°. When angle is zero, engine idles at full speed but no hydraulic fluid is delivered.

pump-input shaft to hydraulic-motor output shaft.

In addition, the driller has a stepless speed-torque increase from zero to full power. There are no clutches in the system and there is no need for reverse gears since the hydraulic motor can be run backwards by reversing the angle of the fluid-pump swash plate.

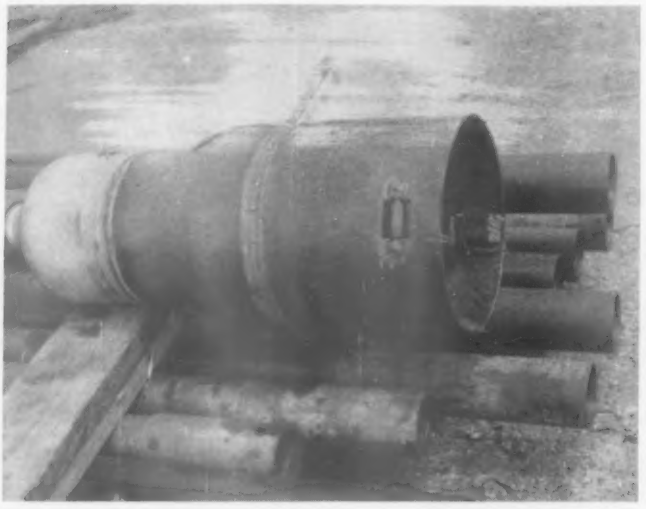
Operating in field. When the outfit is in use of offshore-well servicing, the diesel-engine and hydraulic-pump unit will be on the deck of a work barge some 200 ft. away from the draw works. The draw works itself will be mounted on the helicopter deck of the wellhead platform. The hydraulic oil will be transmitted by 4-in. steel pipe along the deck of the work barge and then by 3½-in. bore rotary hose up to the draw works.

Some 250 Imp. gal. will be required to fill this closed-circuit system. A 400-gal. supply tank is mounted on the No. 2 engine base. For the tropics, an oil cooler is mounted between storage tank and pumps.

The rig's rotary table is chain driven in conventional fashion off the draw works. The mud pump is V-belt driven off the No. 2 engine and will remain on the work barge.

The rig is rated for workovers with 2⅞-in. tubing to a depth of 15,000 ft.

SHOP-BUILT fishing tool holds water-well pump as it's lifted free of the well. One man holds a clamp in position to prevent a possible slip. Fig. 1.



SIDE VIEW of fishing tool shows how the hinged arms attach to the tool's casing. The arms give way when the casing slips down over the submerged pump. Fig. 2.

Here's an ingenious way to fish for a pump

SUBMERGED water well pump-motor units sometimes become separated from the casing they hang from and remain in the well. Such a situation occurred during removal of the pump unit from No. 59 water well at Humble Oil & Refining Co.'s Baton Rouge, La., refinery.

The casing parted and the pump dropped back to its operating level, 280 ft. below grade.

The mechanical crew devised a fishing tool, built it, and removed the pump in 2 days! Generally, recovering water well pumps has proved an expensive, time-consuming task, once requiring 14 days.

Fishing tool was designed to slip over the pump's top and then grip it as the tool moved upward. The tool, attached to a length of 4-in. drill pipe, was lowered into the well opening. One at a time 22-ft. lengths of drill pipe were added until contacting the pump.

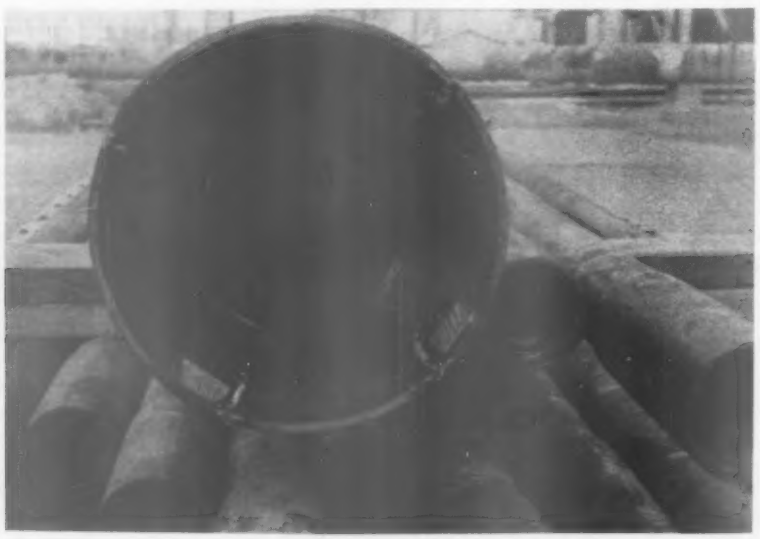
As an extra touch of ingenuity, a dynamometer was inserted between the crane's hook and the top section of drill pipe. Dynamometer reading was 3,100 lb. when the drill pipe contacted the pump. Then the tool was carefully slipped over the pump. Lifting began and the dynamometer reading jumped to 6,500 lb. Pickup was successful.

The drill string was raised one joint at a time until the pump was lifted free of the well.

Taken from "Esso News," a publication of Humble Oil & Refining Co.'s Baton Rouge refinery.

BOTTOM VIEW of the tool shows the shelves which permit the arms to rotate only 90° and thus are able to grip the pump unit when the tool is raised. Fig. 3.

PUMP-MOTOR unit is lifted free of the well. A 4-in. diameter drill string connects to the fishing tool. Fig. 4.



Gas-leak odor stopped with wick device

A METHOD of deodorizing atmospheric bleed gas has been developed by Northern Illinois Gas Co., and it has paid off in better public relations with residents in those areas.

Beginning with a vaporproof light fixture, the receptacle was removed and replaced with a wick. The fixture is filled with a liquid solution—one part of an aromatic oil called "Neutroleum Gamma" and nine parts of kerosine or No. 1 fuel oil—and inserted into the gas stream. The gas, passing over the wick, is deodorized.

Advantages of this method are: Its cost is reasonable. The unit is easily standardized and replacement parts are readily available. It is tapped with ¾-in. pipe taps on four sides, which simplify the hookup. Since it is vaporproof, gas will not leak around the bowl. The heavy gas bowl is strong enough to withstand shock and rough handling and the liquid level can easily be seen. There is a metal guard around the bowl for protection.

REPLACING RECEPTACLE with a wick in a vaporproof light fixture proves a profitable idea. Fixture is filled with an aromatic oil to deodorize bleed gas. Northern Illinois engineer Joe Becia is adjusting the device.

Survey predicts hike in foam use

THE NEXT 5 YEARS should see a big increase in the demand for foams. Production will increase from this year's 248,000,000 lb. to 740,000,000 lb. in 1966. At the same time, demand will increase to 800,000,000 lb.

These are the conclusions of a survey of 35 industries conducted by E. I. du Pont de Nemours & Co. John C. Tallman of Du Pont's marketing research division reported on the development to an AIChE meeting in Lake Placid.

Tallman warned that imagination would be required in developing this market, however. Products should be designed to capitalize upon the unique properties of foam. Producers should never be content simply to replace with foam some other material of construction in a product.

Here's the way the 1966 foam picture looks according to Du Pont:

Upholstered furniture: 140,000,000 lb., which includes 80,000,000 lb. of urethane foams, 50,000,000 lb. of latex foams, and 10,000,000 lb. of vinyl foams—accounting for about one third of all cushioned furniture.

Bedding industry: 100,000,000 lb., including 60,000,000 lb. of urethane and 40,000,000 lb. of latex foams.

Seat cushions for automobiles and trucks: 50,000,000 lb.

Other automotive uses: 80,000,000 lb. for padding instrument panels, sun visors, arm rests, etc.

Textile industry: 20,000,000 lb.

Building industry: 85,000,000 lb., including 55,000,000 lb. of polystyrene foam and 30,000,000 lb. of rigid urethenes. Du Pont said this represents only a small fraction of the potential market. Estimates show that the long-range potential for foams in building insulation alone is over 1 billion pounds per year.

House trailers: 20,000,000 lb. Insulation for low-temperature warehouses, cold-storage rooms, refrigerated railroad cars, refrigerated trucks and ships: 25,000,000 lb.

Electric household and commercial refrigerators: 50,000,000 lb.

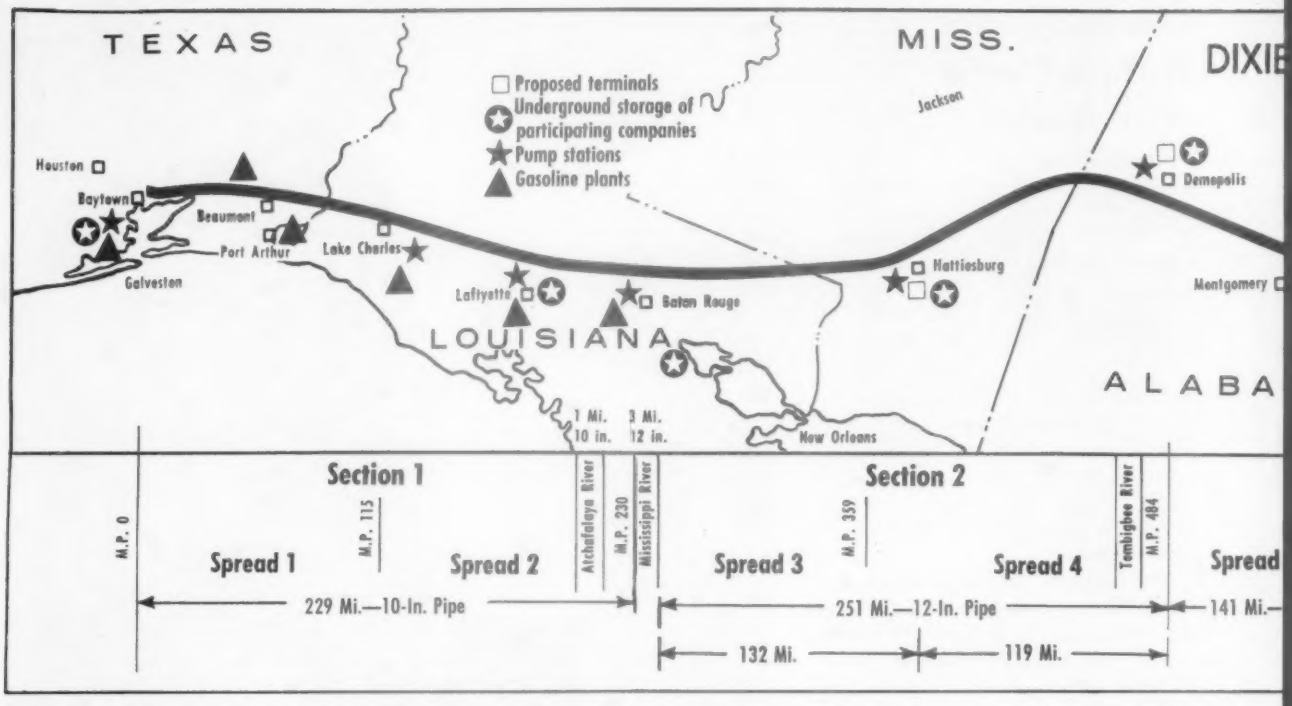
Iusulation for industrial piping and equipment: 25,000,000 lb.

Insulation for electric wiring: 30,000,000 lb.

Packaging industry: 30,000,000 lb.

Marine flotation products: 24,000,000 lb.

Fifteen other fields, including acoustical insulation, air filters, electric potting and encapsulating compounds, aircraft and missiles, railroad passenger cars, busses, shoes, floral and displays, housewares, industrial gaskets and seals, and military: 90,000,000 lb.



ROUTE of 1,080-mile Dixie Pipeline showing location of terminals, pump stations and shippers' underground storage. During the

Dixie's new 1,080-mile LPG line

Receipts and deliveries must be in balance. Line uses variable-speed couplings, packaged switchgear, extra-length joints and record-size, shop-fabricated tanks. Sponge-type scrapers to dry line. Main-line contractors to prepare common sites for stations, terminals and install prefabricated piping.

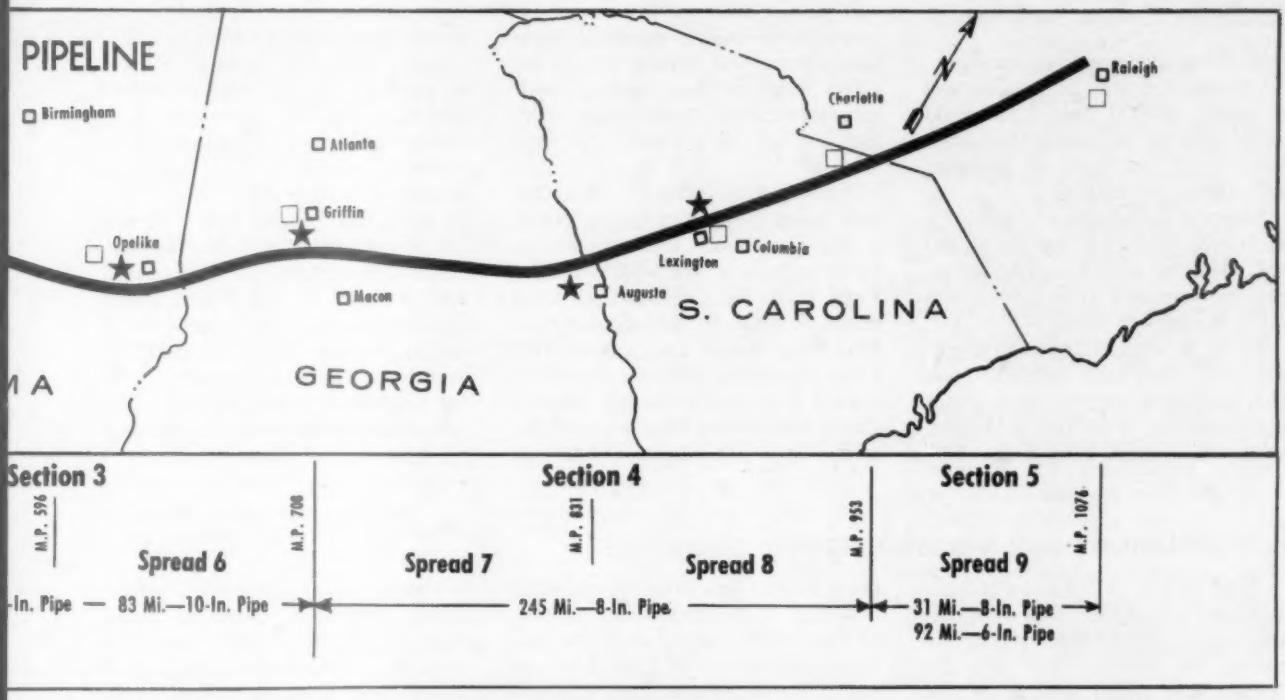
BY PAUL REED AND JOHN P. O'DONNELL
Pipeline Editors

THE 1,080-mile, 65,000-bbl. per day Dixie Pipeline Co. system which will stretch from Mont Belvieu, Tex., to Raleigh, N. C., is described as a "tight line."

The expression derives from the fact that the line can only receive at the rate that propane is taken from terminal points. That, however, is not the only respect in which the Dixie system will be a "tight line."

Propane will be received by the line at a standard specification. Only limited storage will be available at terminals. Pumping and injection stations are to be remotely controlled and unattended. Complete control of the product from acceptance to delivery will be in the hands of Dixie personnel.

The pipeline and stations were



laying of this line, contractors ran into a full gamut of difficulties, including swampy land that bogged down the biggest tractors.

can be considered a "tight" system

designed and are being built under the supervision of Service Pipe Line Co. Phillips Petroleum has a similar role in the design and construction of terminals.

Unusual features. These are some of the unusual aspects of the Dixie system:

Variable speed couplings will be used on all stations. Dixie will be the first major products line designed to use this type of coupling widely. The highly variable load which is expected will justify the higher-cost variable speed units.

Packaged switchgear, including the furnishing, installation, and wiring into terminal strips of all auxiliary devices, will speed field installation and reduce maintenance at pump stations.

Shop-fabricated tanks of 90,000-gal. capacity will provide the only terminal storage. These are believed to be the largest tanks ever shop-fabricated for propane service.

Sponge-type scrapers and extraordinary measures will be taken to insure a dry line before product is turned in.

Long random-length pipe, ranging up to 62 ft. in length, averaged 57 ft. for the entire main line. Its use has reduced the welding by an estimated one-third.

Common sites for pump stations, injection stations, and terminals are being used as much as possible. This will cut down on the number of sites and, consequently, on site preparation. Installation of some prefabricated piping, is being done by main-line contractors.

Prefabricated piping, much of it done at Service's Tulsa shops, includes scraper traps, manifolds, meter piping, and line and junction connections.

Unattended operation will characterize the pump and injection stations. Terminals will be manned initially but they can be converted to key-stop operation if desirable.

The line will operate at a maximum discharge pressure of 1,440 psi. The hydraulics were calculated on the basis of a modified Fanning formula:

$$P = 34.837\, f \frac{B^2\, s}{K^2\, D^5}$$

Where:

P = friction loss, pounds per square inch per mile.

f = friction factor (Stanton and Pennell).

B = barrels (42 gal.) per hour.

s = specific gravity.

K = Aude's line condition factor (efficiency) 94%.

D = inside diameter of pipe, inches.

Construction began in mid-July and is expected to be completed in mid-December. The statons, because of probable extended delivery time of some equipment, are not expected to be completed until some time after the first of the year.

Limited operation may begin in January before the stations are completed. This could be done by using temporary p u m p s and injection pumps for underground storage in place of the main-line pumps.

Line capacity. While the line will have an initial capacity of 65,000 bbl. per day, it is not expected to be initially operated at that rate. If this expectation is true, it will give the operators several

years of less than capacity operation.

Ultimate capacity of the line will be nearly 90,000 bbl. This could be attained by increasing the horsepower and numbers of pumping units at various stations.

Shippers are required to deliver a water-free product to the line at 300 psi. Metering and sampling facilities are provided at reception and delivery points by Dixie.

Principal sources are natural-gasoline plants and refineries and underground-storage points in Texas and Louisiana. Facilities at Hattiesburg, Miss., and Demopolis, Ga., will permit both reception and delivery of propane. At these locations, Dixie will deliver to and receive from existing underground-storage facilities owned and operated by several potential shippers.

Feeder lines. Feeder lines are now being built from supply points to the Dixie line. One of these is an 11-mile, 6-in. line which Humble Pipe Line Co. is building from Baton Rouge. It will connect with Dixie near Baker, La. Service Pipe Line is building and will operate a 2-mile, 4-in. line from the Hudson Gas & Oil plant at Port Acres, Tex., to the Dixie line. Dixie will also be tied into the huge Clemens Dome storage southwest of Houston.

Stock ownership in Dixie is held by eight companies: Warren Petrolum Co., Phillips Petroleum Co., Humble Pipe Line Co., Union Texas Natural Gas Corp., Shell Oil Co., Sinclair Pipe Line Co., Cities Service Co., and Tuloma Gas Products Co. Its officers are: F. B. Neptune, Phillips, president; R. P. Lennart, Service, and E. A. Slade, Okan Pipeline Co., vice presidents; C. J. Senger, Warren, treasurer; and R. A. McIntyre, Tuloma, secretary. Present headquarters are in Tulsa. The operating headquarters are planned for Atlanta, Ga.

Pump stations use variable-speed couplings

VARIABLE-SPEED couplings, packaged switchgear, and considerable use of prefabricated piping are among the features that will distinguish the pump stations of the Dixie pipeline.

Gyrol fluid drives will provide adjustable speed control for the pumps. The Dixie line will be the first in which every pump on the pipeline is driven through a fluid drive. This was necessitated by the unique throughput demands of the system. The great length of the line brings it into areas of widely varying marketing demands. This coupled with normal summer-winter variables results in a broad throughput variation. Use of the fluid drives and their provision for infinitely adjustable speed on completely automatic control produces the operating flexibility demanded by the system.

The Dixie project will be the latest and largest of fluid-drive installations on pipeline pumps. It will use 14 fluid drives.

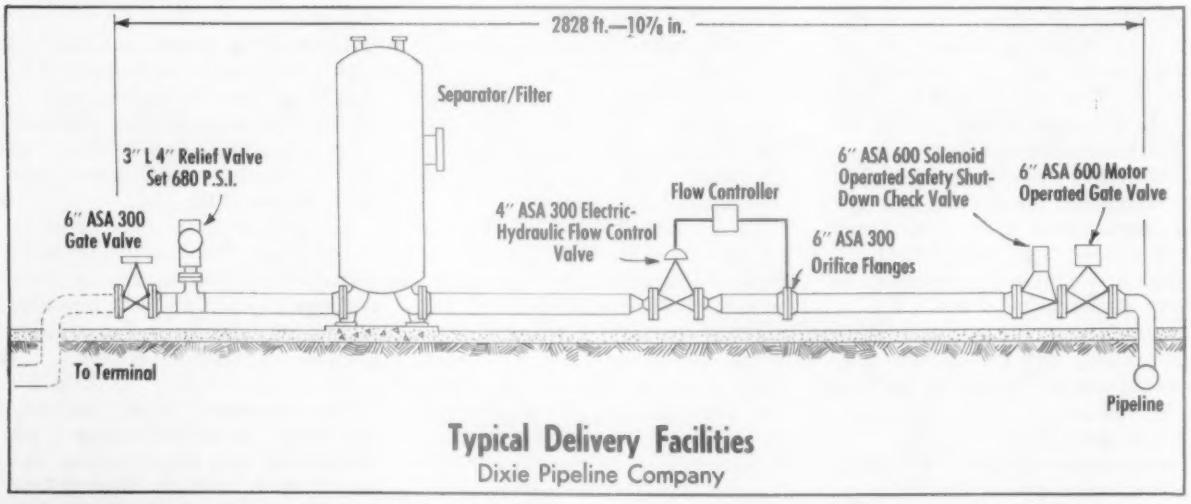
Fluid drive parts. The adjustable-speed fluid drive consists basically of an impeller, a runner, a scoop tube and an oil reservoir. Power is transmitted from the driving member (impeller) to the driven member (runner) by a vortex of oil (see cross-section drawing). The impeller shaft is driven by the electric motor; the runner shaft drives the pipeline pump.

Stepless speed adjustment is achieved by varying the volume of oil between impeller and runner. With maximum oil volume, the fluid drive transmits full power at maximum speed. As the oil volume is reduced, a reduction in pump speed is achieved. Since oil volume is infinitely adjustable, pump speed is also infinitely adjustable throughout the normal operating speed range.

Adjustable-speed fluid drive permits the use of a general-purpose, constant-speed a.c. motor in applications requiring variations in operating speed.

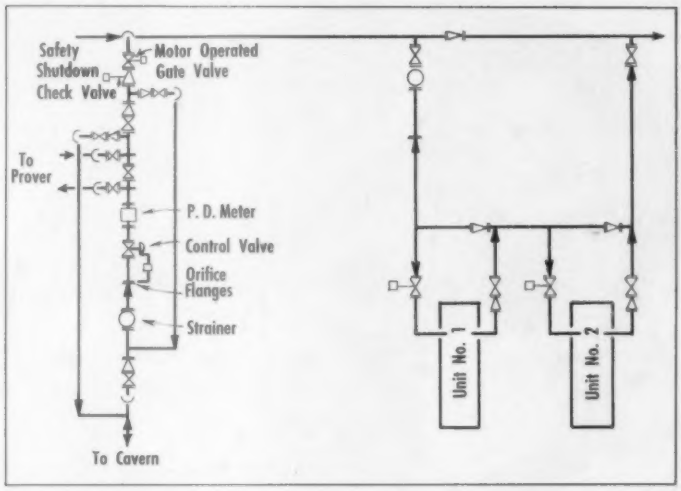
Advantages. Among its advantages are the following:

1. The cushioning effect of the oil provides protection to drive motors and pumps from shock loads, torsional vibration, and excessive torque.

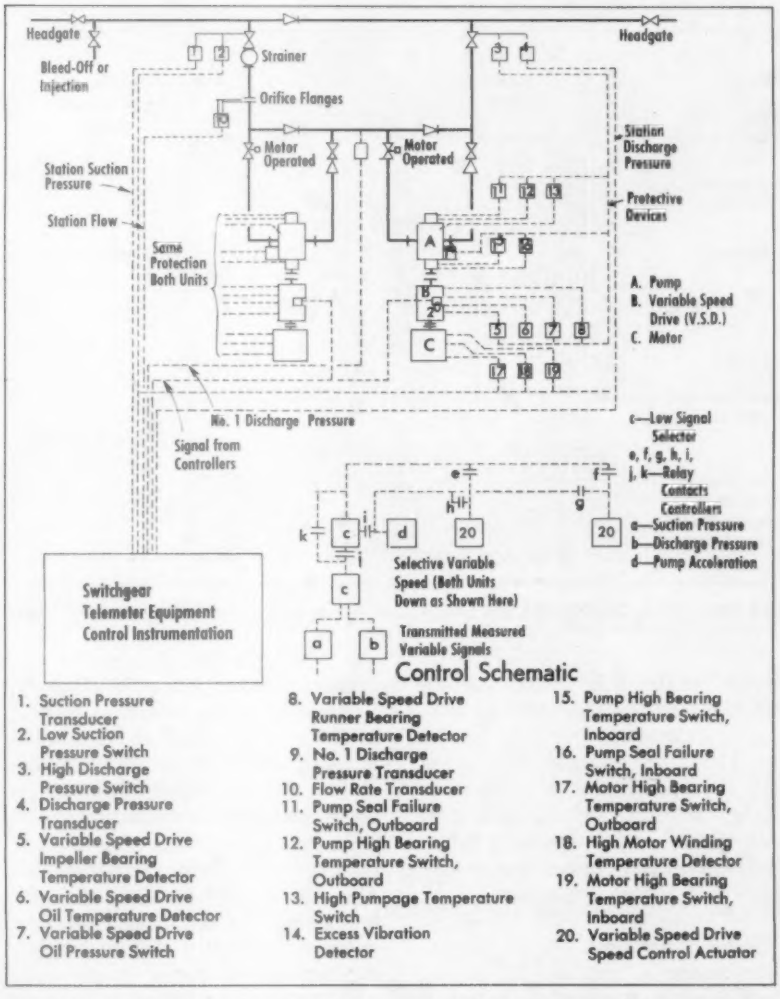

2828 ft.—10⅞ in.
Separator/Filter
3" L 4" Relief Valve Set 680 P.S.I.
6" ASA 300 Gate Valve
4" ASA 300 Electric-Hydraulic Flow Control Valve
Flow Controller
6" ASA 300 Orifice Flanges
6" ASA 600 Solenoid Operated Safety Shut-Down Check Valve
6" ASA 600 Motor Operated Gate Valve
To Terminal
Pipeline

Typical Delivery Facilities
Dixie Pipeline Company

PRODUCT DELIVERED to Dixie system must be water-free but extra insurance is provided by separator/filter before terminals. Alumina bed dehydrators have salt bath heaters for regeneration with heated propane.



TYPICAL INJECTION and delivery at station location. These units will be equipped with piston-type meter provers.


Headgate
Bleed-Off or Injection
Strainer
Orifice Flanges
Motor Operated
Motor Operated
Station Suction Pressure
Station Flow
Same Protection Both Units
Station Discharge Pressure
Protective Devices
A. Pump
B. Variable Speed Drive (V.S.D.)
C. Motor
No. 1 Discharge Pressure
Signal from Controllers
c—Low Signal Selector
e, f, g, h, i, j, k—Relay Contacts Controllers
a—Suction Pressure
b—Discharge Pressure
d—Pump Acceleration
Switchgear Telemeter Equipment Control Instrumentation
Selective Variable Speed (Both Units Down as Shown Here)
Transmitted Measured Variable Signals
Control Schematic
1. Suction Pressure Transducer
2. Low Suction Pressure Switch
3. High Discharge Pressure Switch
4. Discharge Pressure Transducer
5. Variable Speed Drive Impeller Bearing Temperature Detector
6. Variable Speed Drive Oil Temperature Detector
7. Variable Speed Drive Oil Pressure Switch
8. Variable Speed Drive Runner Bearing Temperature Detector
9. No. 1 Discharge Pressure Transducer
10. Flow Rate Transducer
11. Pump Seal Failure Switch, Outboard
12. Pump High Bearing Temperature Switch, Outboard
13. High Pumpage Temperature Switch
14. Excess Vibration Detector
15. Pump High Bearing Temperature Switch, Inboard
16. Pump Seal Failure Switch, Inboard
17. Motor High Bearing Temperature Switch, Outboard
18. High Motor Winding Temperature Detector
19. Motor High Bearing Temperature Switch, Inboard
20. Variable Speed Drive Speed Control Actuator

SUCTION, discharge pressures and flow rate will be telemetered from Dixie stations to control center. All instrumentation is electronic and electromechanical.

2. The drive motor is permitted to come up to speed under virtual no-load conditions.

3. Acceleration control is possible through regulation of the rate of movement of the speed-control lever which positions the scoop tube.

4. The adjustable-speed fluid drive permits full declutching of load from motor at any time during any cycle of operation.

5. All moving parts are continually bathed in oil, hence maintenance requirements are minimum.

Volume control. Oil-volume control, hence pump-operating-speed control, is achieved with a scoop tube which removes oil from the rotating members. A constant volume of oil is pumped through an external cooler into the working circuit by an integral positive-displacement pump. At the same time, oil is returned to the reservoir by the scoop tube.

The position of the scoop tube determines the amount of oil between the impeller and runner. Therefore, scoop-tube position determines fluid-drive output speed. As the scoop-tube tip is moved toward the outside diameter of the rotating elements, the oil volume becomes smaller and pump speed is reduced.

Scoop-tube positioning is a simple mechanical movement readily adaptable to any type of automatic control. In the Dixie pipeline job, an electrical signal sensing suction pressure, discharge pressure, and motor load will be fed to the fluid-drive control mechanism. An electrohydraulic actuator positions the scoop tube in response to the signal. Suitable feedback circuitry will assure accurate pump-speed control.

Automatic welding. Prefabricated piping will include station manifolds, scraper traps, meter piping, and line or junction connections. Much of the prefabrication work is being done at Service's Tulsa shop. Much of the welding was done by the Service-designed, semiautomatic, submerged-arc process which saved considerable welding time.

Main-line contractors will do the site grading, excavation work, and installation of prefabricated piping and valves on the station sites. This will save moving in heavy equip-

ment solely for this particular work.

The stations will be completely outdoors except for a walk-in enclosure for the switchgear, sequencing equipment, telemetering equipment, and control instrumentation.

Most of the stations will share sites with terminals or injection stations. Since the terminals and injection stations will be equipped with piston-type meter provers, such facilities will be available for those stations. Both injection and delivery connections will be made on the suction side of the stations.

Packaged switchgear equipment is being built to Service specifications. Packaging of the switchgear will contribute to standardization, speed field installation, improve interchangeability and reduce maintenance.

Fail-safe provision. Stations, eventually, will be remotely operated and unattended. Local protective devices and controls will have a fail-safe or status quo feature so that operation will continue if communications are lost.

A digital system, relay or solid-state, will be used for controls and telemetering. It will make it possible for complete control and monitoring of pumping stations, and reception and delivery points from a dispatching center. It will be operated over leased circuits and will be an 0-15 cycle, telegraph-quality system.

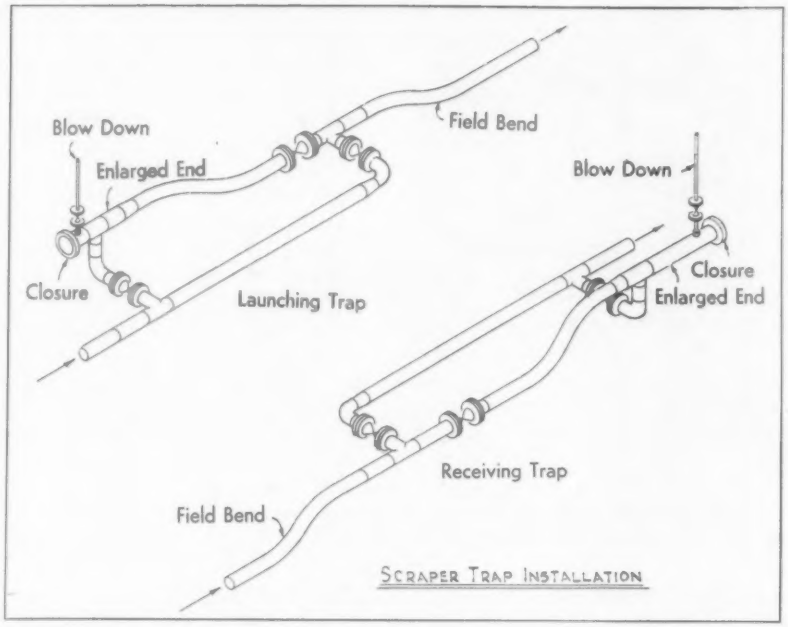
Selective calling teletype service will be leased for dispatching. It will function between reception points, terminals, and the dispatching center.

Switchgear components. The 2,300-volt switchgear is of standard metal-clad, indoor design with drawout air circuit breakers and consists of the following:

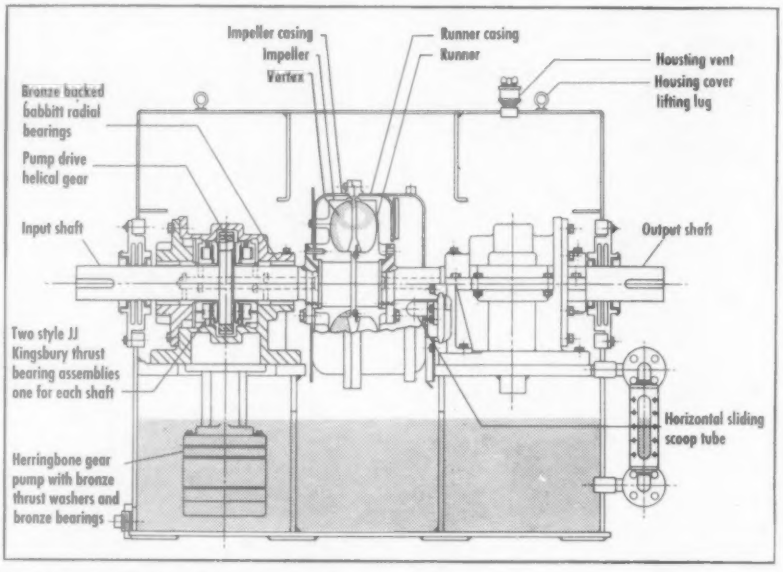
1. Auxiliary cubicle which houses the surge protective equipment, the 2,400-240/120 volt, three-phase and single-phase dry-type transformers for metering and ground detection.

2. Incoming line cubicle which houses the main breaker and its associated protective relaying.

3. Motor starter and sequence-control cubicle which has two sections. One houses the drawout air circuit breaker for motor starting and stopping together with its current transformers, overload relays, etc. The other contains the necessary sequencing and protective relaying, selector switch, start-stop push-butons, and annunciator lights. This section also houses the power-factor connective capacitors.



SCRAPER TRAPS will be located at each point of change in line size. Runs will not exceed approximately 200 miles in any instance.



VARIABLE-SPEED COUPLINGS are being used throughout Dixie line. Extreme ranges in volume dictated choice of this equipment.

Standby batteries. A set of batteries assures a constant 48-volt d.c. power supply for control purposes during fluctuations and outages of primary normal a.c. power supply.

Because of the potential growth of Dixie's operations and in the interest of uniformity and interchangeability, all switchgear installations on the pipeline are identical and can operate with the largest motors anticipated for future requirements. The station main breakers and motor starters are interchangeable and in an emergency the main breaker can replace the starter by installing a short-circuiting jumper in the main breaker cubicle.

FRACTURING SUCCESS *may depend on your selection of the* RIGHT PROPPING AGENT

FIRST...

AND FOREMOST

IN FORMATION

FRACTURING

These three photomicrographs represent the business end of a fracturing job. These particles have to keep the fracture open when the treating pressure is released. Enlarged several times, they may even look alike . . . but they don't *act* alike! Knowing which one will work *best* in your well may mean the difference in the success of the treatment.

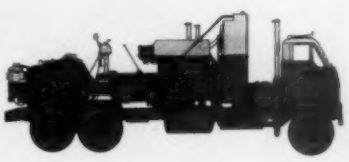
On top of the heap is a grain of Ottawa Sand, the most popular type of propping agent used today in formation fracturing. In many formations, sand grains will adequately prop the fracture to permit increased reservoir drainage. However, formation characteristics may be such that sand grains will crush and shatter or embed, allowing the fracture to "heal" . . . what then?

The answer to these conditions frequently lies with the other two propping agents shown above. Aluminum pellets, or processed walnut hulls will not normally shatter under extreme loading. Instead, they tend to deform to a wafer-like shape, still providing propping support for the opened fracture.

Your Halliburton man will be glad to assist in having a core sample from your well tested so you may select the best propping agent for a particular formation. See him before planning your next fracturing treatment.

FRACTURING SERVICES

Halliburton
COMPANY · DUNCAN OKLAHOMA



Special report on:

Refinery Instrumentation and Control

NEXT WEEK, the Journal will feature a timely report on instrumentation and control, one of the most talked-about topics at refineries and petrochemical plants. It will include:

- Activity in closed-loop, on-line control of refining and petrochemical processes by large-size digital computers.
- The steps which must be taken by a computer manufacturer and an oil company to reach contract and on-line operating stage.
- Descriptions of several operating installations.
- An estimate of the rate at which large-size digital on-line computer control is expected to be applied in the oil and gas industry.
- The type and extent of work being done with analog-computer control.
- New developments in process-stream analyzers.

Watch for this special section in The Oil and Gas Journal's October 23 issue.

The specifications for the switchgear include the furnishing, installation and wiring into terminal strips of all auxiliary devices such as vibration detectors, temperature detectors, sequencing and lockout relays, etc. This will facilitate field installation of the equipment by reducing the amount of interconnecting wiring between various control panels.

The 240-volt, three-phase motor-control center for operating gate valves and variable-speed-coupling cooling fans is mounted in a separate cubicle. The motor-operated gate valves which permit flow into and out of the pipeline can be operated locally, by remote control or, in an emergency, will close automatically from high-pressure-detecting switches.

Valve operation. For normal operation, the station suction and discharge valves remain open at all times. Only the suction valve is motor-operated and it will close automatically in event of a station lockout type failure. It can be opened only by local control and must be open for normal sequenced starting.

The motor-operated fans for the hydraulic couplings operate automatically from the temperature level of the fluid or by manual push-buttons. Oil circulation for the coupling is furnished by a pump driven from the input shaft.

A cubicle is provided for housing station instrumentation and control devices. The specifications for this equipment include the mounting of instruments and wiring into terminal strips. The instruments consist of station flow recorders, station suction and discharge-pressure recorder-controllers, flow controllers for flow into or out of the pipeline, ramp function generators, remote setpoint positioners for flow control, and encoder positioners for telemetering flow and pressure information. All of this instrumentation is of the electronic and electromechanical type. Equipment in this cubicle will be loop-checked and calibrated.

Set suction pressure. The pumping units will operate through the variable-speed coupling so as to maintain a set suction pressure. A setpoint on the station discharge pressure will override the suction-pressure controller signal if the discharge-pressure limit is reached. Flow into and out of the line will be established by the local or remote setting of rates through flow controllers.

The purpose of the ramp function generator is to provide a signal on startup which will permit a pumping unit to be brought on the line gradually. At two-unit stations the ramp function generator will bring the first unit started on the line gradually and if the second unit is started the ramp function generator will gradually bring it to full speed and will shift from the first unit and allow its speed to vary in conformance with the controlling pressure signal.

The sequence control is designed so that before a unit can start the suction and discharge valves must be fully open, the variable-speed coupling in a declutched position, the emergency stop button in the run position and all lockout relays reset. When these conditions are met the unit may be started locally or remotely.

Control sequencing. The control sequencing provides for shutting down both units at a two-unit station should a fault on either unit occur. This is necessary because the pressure differential across a two-unit station is such that when one unit ceases to run, the line pressure will decrease so slowly that the other unit cannot produce sufficient head to maintain flow through the pump and internal seizure of the rotating element could result.

At each station a four-position selector switch is provided for starting locally, or remotely. When this switch is in the hand position the unit can be started but all starting-sequencing devices are shunted. This position is primarily for maintenance purpose. The switch can be placed in local sequence position and if the unit is started it will proceed through the complete starting sequence. This position isolates the unit from remote control. A third position is provided for remote control and when the selector switch is in this position the local control is shunted except for an emergency push button which can be used to stop and lockout the unit. The fourth position is stop and will prevent starting the unit by any means.

Shutdown devices. Shutdown lockout devices are grouped into two categories depending on whether they can be reset remotely or locally. These are grouped as follows:

1. Local reset only: Low d.c. control voltage, motor overload, motor bearing temperature, pump bearing temperature, variable-speed-

coupling bearing temperature, mechanical-seal failure, excessive vibration, main breaker open, and variable-speed-coupling low oil pressure.

2. Local or remote reset: Low a.c. voltage, low suction pressure, high discharge pressure, low instrument a.c. power, and two-unit shutdown.

Staton pumps will be horizontal, steel split-case, multistage centrifugals operating at 3,600 r.p.m. The motor will be 2,300-volt, three-phase, 60-cycle, induction type units with weather-protected enclosures. All arcing contracts will be housed in sealed, explosionproof equipment.

Underground conduits. Conduits between the units and the control building will be installed underground. The control buildings will be located at least 100 ft. from operating units.

Six of the pump stations will be connected to underground storage. These are the Mont Belvieu, Lake Charles, Breaux Bridge, Baton Rouge, Hattiesburg, and Dempolis stations.

All injections will be measured by a noncompensated p.d. meter and piston-type power system. Stations at Lake Charles, Breaux Bridge, Hattiesburg, and Demopolis will be so manifolded that a single meter installation can be used either for receipts or deliveries.

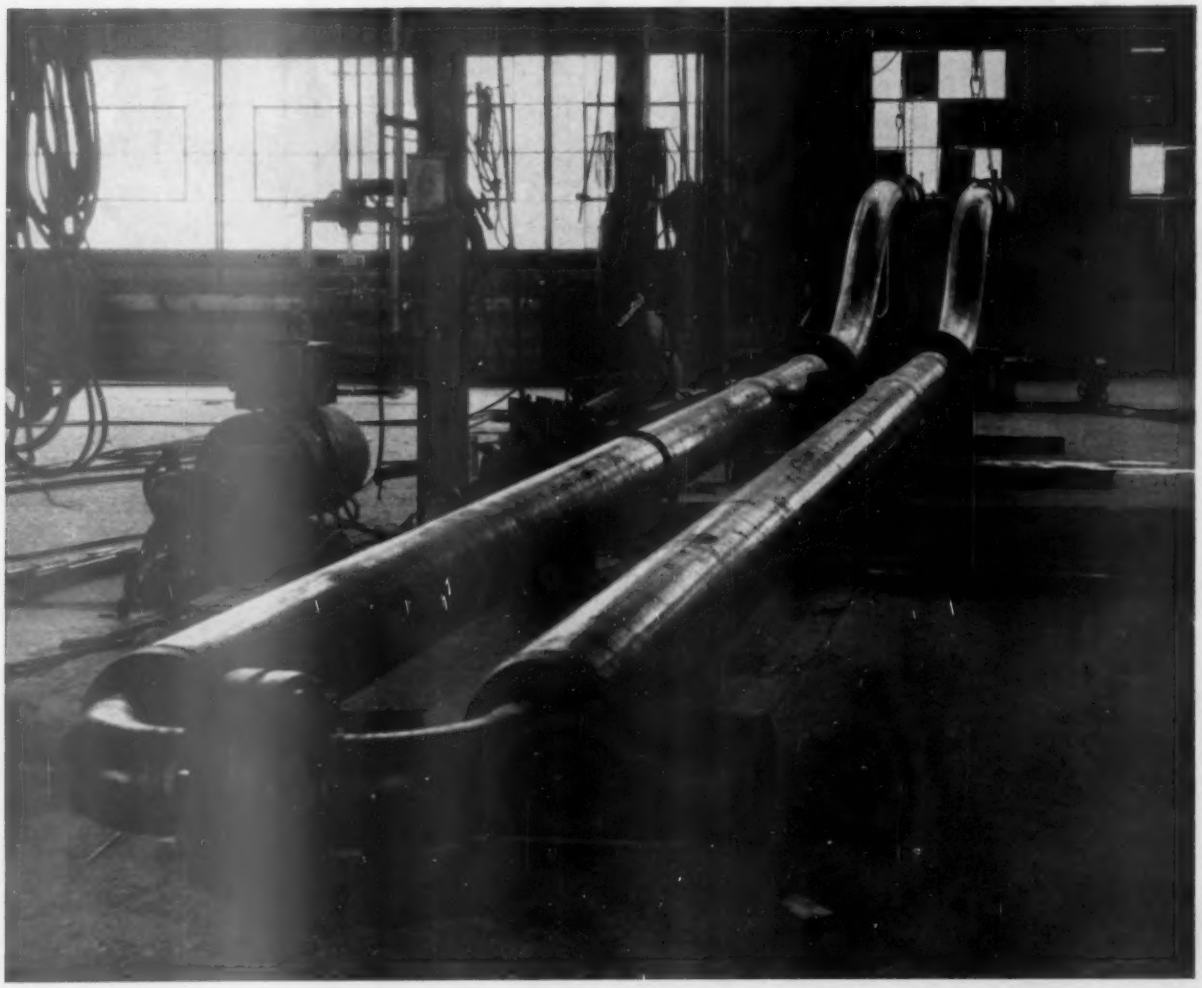
Main-line welding cut by long strings

THE PIPE on the Dixie system is from domestic mills. All is electric-welded type with the exception of Grade B seamless pipe used in river crossings. Grade X-52 used in 12, 10, and 8-in. sizes, with X-42 used in the 92 miles of 6-in. on the eastern end of the line.

The maximum length of joints for the line is 62 ft. The average length is approximately 57 ft.

These greater-than-average lengths have added only slightly to to handling problems. These minor complications have been more than offset by the greater speed and fewer loads involved in stringing the pipe.

Fewer welds. The greatest advantage of the longer pipe, however, is a marked reduction in the number of welds required. Service engineers estimate that a one-third reduction of welds has been attained.



MUCH OF THE PIPING for Dixie pump stations is being prefabricated in Tulsa. These are launching units for scraper traps to be installed as part of site preparation by main-line contractors. Stations and terminals share common site as often as possible.

CONTINENTAL-EMSCO ANNOUNCES

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LAYING OF THE DIXIE LINE is described as a "tough" job. There are few difficult grades but much of route lies in swampy areas not only in Louisiana and Mississippi but also in Alabama and Georgia.

The pipeline contractors like the longer pipe. Since the pipe gang paces the progress of construction, the reduction in the amount of welding appreciably accelerates the rate of pipe laying.

All welds will be X-rayed only on the major river crossings. Elsewhere X-raying will be done at the discretion of the inspectors.

Coating program. Coating for the Mont Belvieu-Baton Rouge section will be yard-applied. A 3/32-in. coal-tar enamel with a 15-lb. felt wrapper is being used in parts of this section with somastic coating being used in wet areas. Both types of coating are being applied in two coating yards at Harvey, La.

East of Baton Rouge, the pipe will be coated with 3/32-in. of coal-tar enamel with the 15-lb. felt wrapper. It is being applied over the trench.

Coating at river crossings on major streams is either ½-in. somastic and 1-in. concrete jacket, 1-in. somastic coating, or ½-in. somastic coating for the smaller-diameter lines.

Cathodic protection will be installed after the backfill has settled. It will start in the spring and is expected to be completed next summer.

Selenium rectifier units will be used. They will be installed at intervals of approximately 40 miles. They will be sized to use fully the energy available at the minimum rate initially. They will have reserve capacity to meet future needs.

Insulated flanges. All connecting lines, major river crossings, stations, and terminals are being electrically isolated with insulated flanges. Test stations are being installed at approximately 1-mile intervals, as well as at foreign line crossings, casings, and insulating flanges.

No provisions has been made for inhibitors or internal corrosion control. Since specifications call for a water-free product, no problems of this type are anticipated.

Weld-end, through conduit block valves, are being installed at each side of major rivers and navigable canals. Each installation will be elevated and will have 2-in. bleed-off connections on either side of the valve. These valves are near roads for easy accessibility and are about 2 miles apart in congested areas and 15 miles apart in open country.

Scraper launching and receiving facilities, designed to handle both spheres and conventional cup-type scrapers, are being installed at each end of the 6, 8, 10, and 12-in. sections. Others will be installed so that scraper runs will not exceed some 200 miles.

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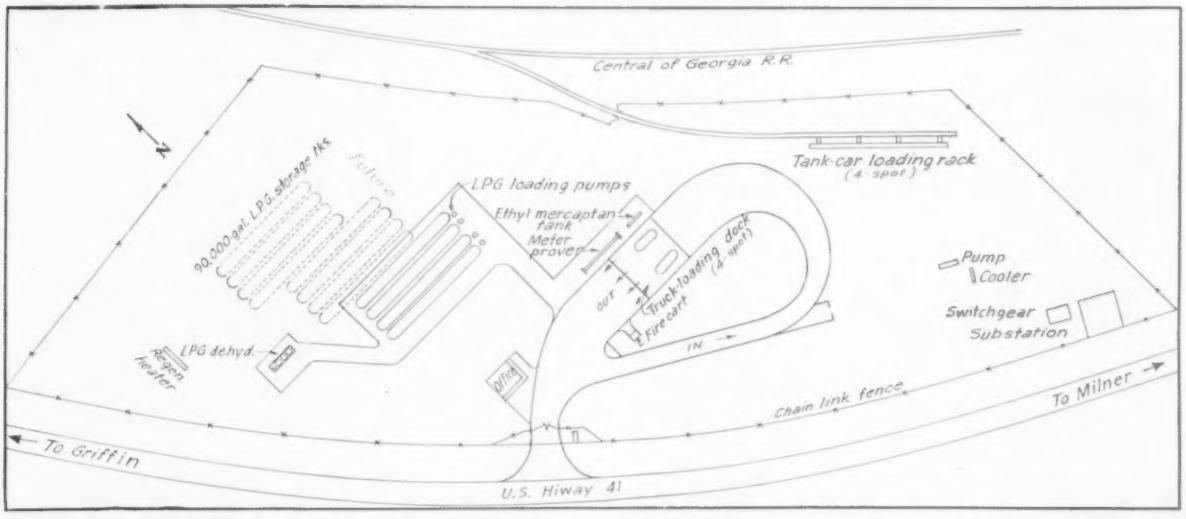


THIS IS A "TYPICAL" LAYOUT of one of the Dixie terminals. Five will have two-spot and two will have four-spot loading racks for tank trucks. Two, Griffin and Raleigh, will also have tank-car-loading facilities. All are planned for expansion.

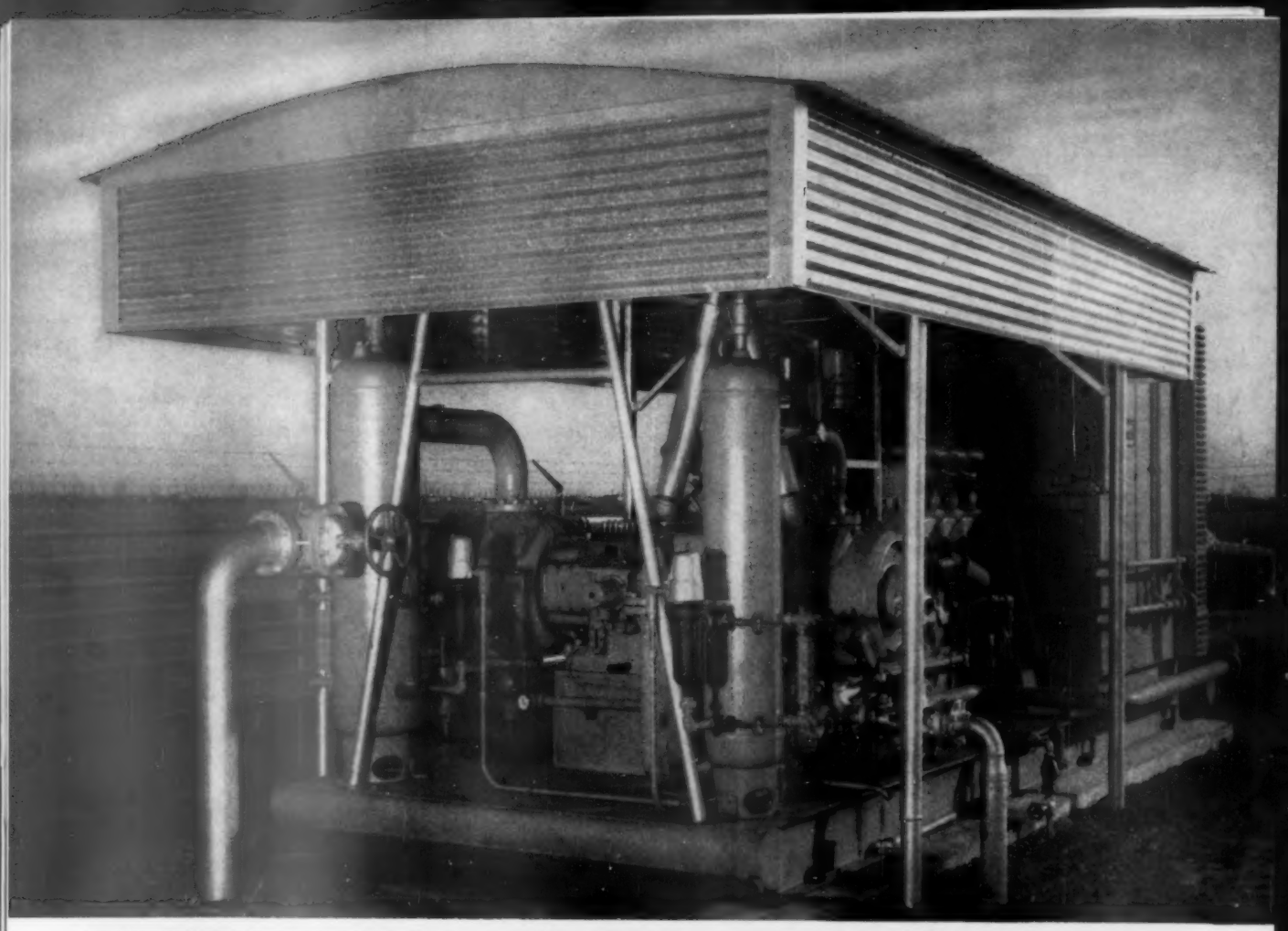
Terminals have 90,000-gal. storage tanks

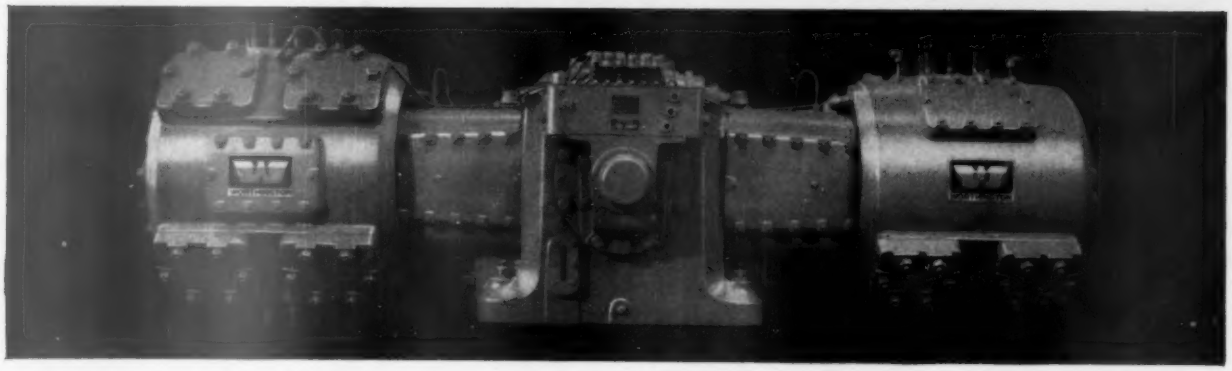
FIVE OF THE SEVEN terminals that will be located along the Dixie pipeline initially will be two-spot—capable of loading two tank trucks at a time—and two of them four-spot or four-tank-truck capacity.

Four-spot terminals will be located at Opelika, Ala., and Griffin, Ga. The two-spot terminals will be at Hattiesburg, Miss., Demopolis, Ala., Columbia, S. C., Cheraw, S. C., and Raleigh, N. C. A typical layout is shown in Fig. 1.

Both the Griffin and Raleigh terminals will load tank cars as well as tank trucks. They will be the only terminals with tank-car loading facilities from the start but all others, except Opelika, are accessible to rail sidings and will have them when demand justifies their installation. Both the Griffin and Raleigh terminals will be able to

THIS SIDE-BOOM is handling 99% plus of its maximum load. Five contractors have nine spreads at work on main line. Construction began in mid-July and is to be completed in mid-December.





SHOULD YOU TAKE GAS FROM A WELL?

There's a big difference in opinion about when it is profitable to take gas from a well. It depends on price contracts, on company policy of time limit on payout, on alternatives for capital investment and on other factors, such as the economics of the well itself. To lower your well cost picture, Worthington now offers the new CUB compressor.

Through a wide range of cylinder sizes, the CUB handles over 85% of gas field needs. The cylinders are designed for extremely fast field changes to meet changing capacities and pressures.

The CUB cylinder-and-piston arrangement is balanced-opposed. This cuts vibration to a level below other compressor designs. It reduces supporting base requirements and lengthens compressor life.

Main crankshaft bearings in the CUB are the more expensive, spherical-roller-bearing type. You'll find it runs with less friction, runs cooler, and maintains better full end-thrust control.

Lubrication in the CUB is improved, too. Oil is continuously cleaned by a built-in filter that is readily serviced without disturbing piping. All lubrication is done by a full, force-feed system. And crankcase oil is water-cooled down to a conservative operating temperature by an oil cooler enclosed in the frame itself.

You'll find, too, that the CUB is compact to make an easier installation. Piping is less, only one water inlet and two water outlets. There are no external oil pipe connections.

For more information on the CUB, write Worthington Corporation, Section 36-19, Harrison, N. J. In Canada, Worthington (Canada) Ltd., Brantford, Ontario. Or call your local compressor packager.

WORTHINGTON

PRODUCTS THAT WORK FOR YOUR PROFIT

DIGGING TRENCH in occasional sandy soil poses little problem for contractors. On four of five sections contractors have two spreads, one working from each end toward middle.

accommodate the largest tank cars in service.

Phillips design. The terminals have been designed by Phillips Petroleum Co. and Phillips engineers will supervise their construction. A. D. Graham, senior project engineer with the construction division of Phillips' engineering department, and J. H. Nichols, a Phillips supervising project engineer, have been assigned to the Dixie project. Graham is serving as project manager and Nichols as project design engineer for Dixie. C. G. Goss, chief engineer, Phillips Pipe Line Co., is chairman of the Dixie engineering committee.

Each spot at the terminals will be capable of loading a tank truck at the rate of 500 g.p.m. using the spray-loading method. This method uses top and bottom loading simultaneously. The bulk of the product is bottom-loaded while propane is sprayed into the vapor space at the top to cool vapors and reduce pressure.

The loading will be done through filters and positive-displacement meters. Each terminal will have a bidirectional, piston-type meter prover. These provers will use spheres in preference to plugs in the belief that they will be more wear-resistant. The first unit was shop-tested with propane before fabrication of the remaining provers was undertaken.

Pneumatic controls. All-pneumatic controls will be used throughout the terminals. Phillips has had three full seasons' experience with such controls and is entering its fourth, having a record of proved use. These controls will be tied in with Dixie's telemetering system.

While a remotely-controlled, key-stop type of operation will be possible, the Dixie terminals will be attended by as many as four loaders during peak periods. One reason that the stations will be attended is that the propane is odorized before delivery. Development of a system or unattended odorization system that will meet state requirements is under consideration.

The terminals have a single gate and can easily be converted to a gate-type, key-stop operation if desired.

Each terminal will have a hydraulic safety shutdown. This device will shut down valves and electrical equipment from remote points in the event of a broken line, fire, etc.

Manual sampling. Sampling will be done manually. Moisture monitors may be added in the future.

Alumina-bed dehydrators are being installed at each terminal. Those at two-spot terminals will have a capacity of 500 g.p.m. and those at four-spot terminals, 1,000 g.p.m. Salt bath heaters will be used for heating propane to be circulated through the beds for regeneration.

Terminal storage will consist solely of 90,000-gal. horizontal tanks. Two such tanks will be located at the two-spot terminals and four at the four-spot terminals. These tanks are 10 ft. 11⅞-in. in diameter and 134 ft. 3-in. in length.

The tanks are shop-fabricated and are being moved to the most convenient railhead on a trio of flat cars. They are moved from the railhead to the terminals under Phillips' supervision.

These oversize tanks are the largest ever shop-fabricated for propane use. Their large size is expected to result in a savings in storage costs of close to 25%. Another inherent advantage is that they will require less piping and manifolding.

While the horizontal tanks will be the only storage at the Dixie terminals, some potential shippers now have underground storage of their own which will be connected to the line. These, in turn, will operate their own terminals separately from the Dixie terminals.

Retarded Acid Gets Results in Problem Wells

This table shows some of the recent results of Retarded Acid treatments performed by Dowell on problem wells in many areas. We hope it gives you some ideas that will result in greater profits from your wells.

LOCATION	NAME OF FORMATION	AMOUNT OF RETARDED ACID	RESULTS
Albert, Canada	Slave Point Mid Devonian Vugular lime	4000 gallons (acid-oil-emulsion type)	Production from old well went from 0 to 218 bopd.
Franklin County, East Texas	Limestone	30,000 gallons	16-fold gas production increase—from 400 mcfd to 6400 mcfd.
San Juan County, Utah	Paradox (Desert Creek Zone)	75,000 gallons (acid-oil-emulsion type)	Production boost from old well was 34 to 450 bopd in field where regular acid treatments are usually unsuccessful.
Ellis County, Kansas	Kansas City Lansing	2000 gallons (acid-oil-emulsion type)	Production nearly three times that of offset wells. $881 treatment cost paid out in 19 days.
Andrews County, West Texas	Pennsylvanian	10,000 gallons (acid-oil-emulsion type)	Production from old well boosted from 10 bopd to 60 bopd stabilized. This 50 bopd increase was made in a field where offset wells treated with 10,000 gallons regular acid usually yield an uneconomical 5 bopd increase.
Logan County, West Virginia	Big lime	4000 gallons	Production increased 100-fold to one million cfpd. Treatment cost paid out in two weeks. Entire well cost paid out in less than five months.
Lea County, New Mexico	Wolfcamp lime	3000 gallons (regular type) 15,000 gallons (acid-oil-emulsion type)	Well tested 275 bopd flowing. Other wells in field, given regular acid treatments, do not usually respond properly.
San Juan County, Utah	Paradox	40,000 gallons	Decline rate was reduced by treatment. Production was increased from 200 bopd to 700 bopd. Six months later production was still 700 bopd.
Alberta, Canada	D2	5000 gallons	Production from eight-year-old well had declined to zero with fluid level only 65 feet. One month after treatment, production had leveled off at 100 bopd, flowing.
Russell County, Kansas	Kansas City limestone	3000 gallons	Production boosted from 3 bopd to nearly 2000 bopd on test after clean-up.
McKenzie County, North Dakota	Madison lime	7000 gallons (acid-oil-emulsion type)	Production from old well increased from 35 bopd to 133 bopd after treatment. $3101.00 treatment paid out in 23 days.
Harrison County, East Texas	Pettit Oolitic lime	7000 gallons	Treatment of six-foot pay resulted in 40 mmcfd well with 60 barrels petroleum liquids per million.
Wabash County, Illinois	O'Hara lime (Highly soluble)	3000 gallons (acid-oil-emulsion type)	Well production stabilized at 75 bopd and treatment cost paid out in ten days. Regular acid had given poor results on nearby wells.
Fremont County, Wyoming	Embar lime	5000 gallons (acid-oil-emulsion type)	21 boph test from a pay that had been acidized and abandoned several years before. This treatment saved a well that would have been plugged otherwise.

Almost without exception, these treatments employed other Dowell products and services in addition to Retarded Acid. Most of the more recent treatments listed here were designed by Dowell engineers with the aid of the Acid Guide* – a method developed by Dowell for use in engineering acid treatments to get optimum results.

Take full advantage of Dowell's long experience, proved additives, and engineering ability. Call Dowell to perform your next acidizing treatment. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina, Germany, France and the Sahara area. Dowell, Tulsa 1, Oklahoma.

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Construction

FIVE CONTRACTORS, using nine spreads, are sharing the construction of the Dixie pipeline. They began work in mid-July and are expected to complete the laying of the line early in December.

Much of the route is through swampy, heavily wooded country. The swamp areas are not confined to Louisiana and Mississippi but extend into Alabama and Georgia. Even though there are no marked changes in elevation, laying the line is considered a "tough" job.

In mid-September, the nine spreads were averaging 1½ miles per spread per day. The maximum rate ranged from 18,000 to 20,000 ft. per day.

Here's the way the job is divided:

Section I: Spreads 1 and 2, 226 miles, 10-in. from the east side of State Highway 146, approximately 1 mile north of Mont Belvieu, Chambers County, Texas, to a point adjacent to the west levee of the Mississippi River, approximately 1 mile northeast of Smithfield, West Baton Rouge Parish, Louisiana. Contractor: Houston Contracting Co. J. E. Chapman is Service's construction manager with offices in Baton Rouge.

Section II: Spreads 3 and 4, 246 miles, 12-in. from a point approximately 1¼ miles west of Alsen, East Baton Rouge Parish, Louisiana, to the west side of State Highway 40 and U. S. Highway 43, approximately 3½ miles southeast of Demopolis, Marengo County, Alabama. Contractor: Sharman, Allen, Gay & Taylor, Inc. J. J. Wright, Montgomery is construction manager.

Section III: Spreads 5 and 6, 157 miles, 12-in. and 50 miles, 10-in. from the west side of State Highway 40 and U. S. Highway 43 to a point on the west side of U. S. Highways 41 and 341, 2½ miles north of Millner, Lamar County, Georgia. Contractor: H. B. Zachry Co. Wright also supervises this section.

Section IV: Spreads 7 and 8, 248 miles, 8-in. from the west side of Highways 41 and 341 to a point on the west side of State Highway 261, approximately 2½ miles north of McBee, Chesterfield County, South

Carolina. Contractor: O. R. Burden Construction Co. L. E. Anderson, Cayce, S. C., is construction manager.

Section V: Spread 9, 31 miles, 8-in., and 92 miles, 6-in., from near McBee to the end of the line at a point on the east side of U. S. Highway 64, approximately 1 mile east of Cary, Wake County, N. C. Contractor: Stanley-Bledsoe Corp. This section is supervised by Anderson.

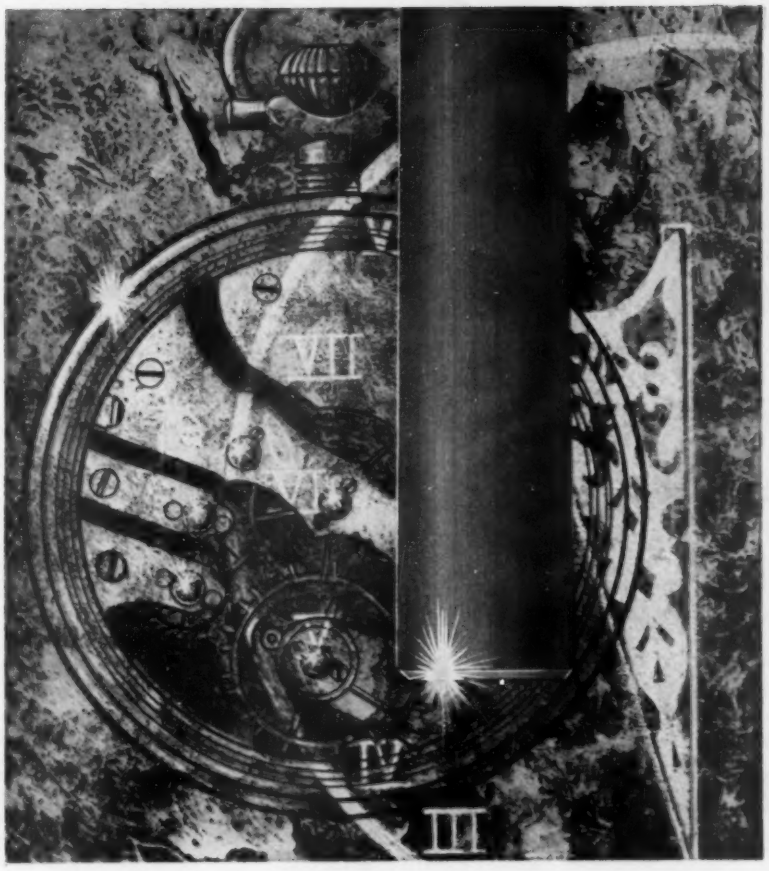
River crossings. All river and stream crossings are being made by these contractors except for the 5,500-ft. crossing of the Atchafalaya near Krotz Springs, La., the 3-mile crossing of the Mississippi north of Baton Rouge and the crossing of the 600-ft. Tombigbee near Demopolis, Ala. Pentzien, Inc., is laying the Mississippi crossing, Houston Contracting Co., the Atchafalaya, and Sharman, Allen, Gay & Taylor, Inc., the Tombigbee.

Twenty river crossings will be laid by the main-line contractors. They range in width from the 300-ft. Calcasieu, Flint, and Ocmulgee to the 1,100-ft. Chattahoochee in Georgia. In addition there are 372 railroad and road crossings that will require casing. This is the casing program by sections:

Section	No. rail crossings	No. road crossings	Casing Quantity	Casing Size
I	17	49	5,840 ft.	14-in.
II	10	63	6,700 ft.	16-in.
III	11	60	5,900 ft.	16-in.
III	7	29	3,020 ft.	14-in.
IV	13	25	8,440 ft.	12-in.
V	8	53	5,030 ft.	10-in.
V	2	15	1,410 ft.	12-in.
Total	**68**	**304**	**36,340 ft.**	

Three carriers are stringing the pipe: J. O. (Red) Willett Pipe Line Stringing Corp., Section I; Parkhill Trucking Co., Section II and the 12-in. portion of Section III, and J. L. Cox & Son, the 10-in. portion of Section III and Sections IV and V.

Marsh areas. Because much of the line is being laid through marsh country, contractors are being compensated for swamp construction. Swamp and marsh are defined as areas exceeding 300 ft. in length where it is necessary to



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DIXIE SYSTEM

1. Lay pipe by the flotation-ditch method.
2. Lay pipe by the push-ditch method.
3. Where construction can be carried on adjacent to the ditch in a conventional manner but where it is necessary to install heavy timbers and build corduroy roads on the right of way to support construction equipment.

On river crossings, the line must be laid to conform to the profile if one is furnished by the company. In no event is the top of the pipe less than 4 ft. below the bottom of the river except where solid rock is encountered. In those cases, the top of the pipe must be at least 6 in. below the surface of the rock. The entire length of crossings must be laid on the bottom of the trench.

When banks of a river are disturbed, the contractors are required to restore them and protect them from erosion. This can be done with cloth bags filled with one part cement and seven parts sand or with rock riprap.

Special pipe-laying instructions apply only to the electric-welded pipe. It must be laid so that the longitudinal seam will be within 30° of the top center and consecutive joints rotated so that the seams will be on alternate sides of the top center.

Inspection staff. Since Service is responsible for the construction as well as the design of the line, it has set up field offices at Baton Rouge, La., Montgomery, Ala., and Columbia, S. C. Each supervises the work of three of the nine main-line spreads.

The west segment, 359 miles from Mont Belvieu to Hattiesburg, Miss., is supervised from Baton Rouge, the central segment, 344 miles from Hattiesburg to Griffin, Ga., from Montgomery, and the east segment, 374 miles from Griffin to Cary, N. C., from Columbia. The Service staff includes a project engineer and three spread engineers for each segment.

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Ever see a water flood?

A capillary micromodel has been used to study fluid distributions under various wettability conditions, and to find the effects of wettability on water-oil displacement. This article gives the results of these studies, with detailed photographs of the events occurring within the model.

BY C. C. MATTAX AND J. R. KYTE
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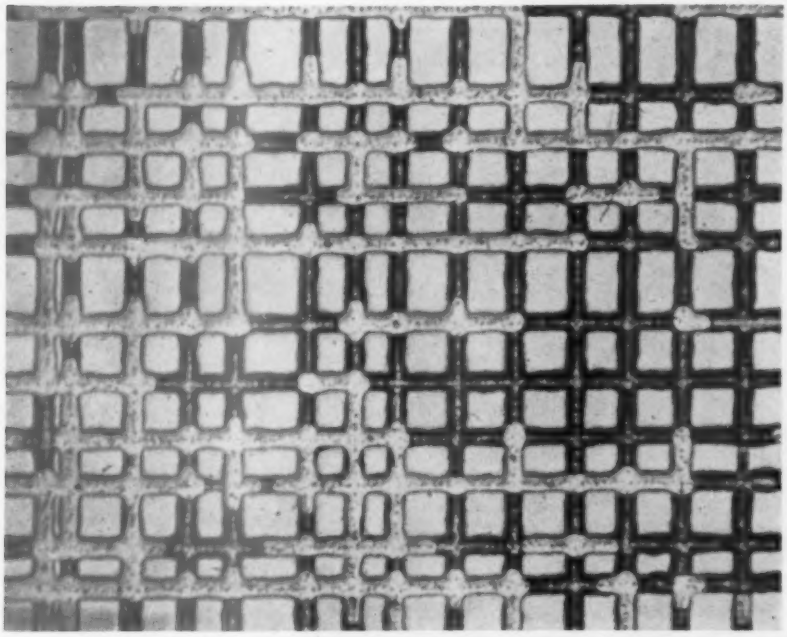


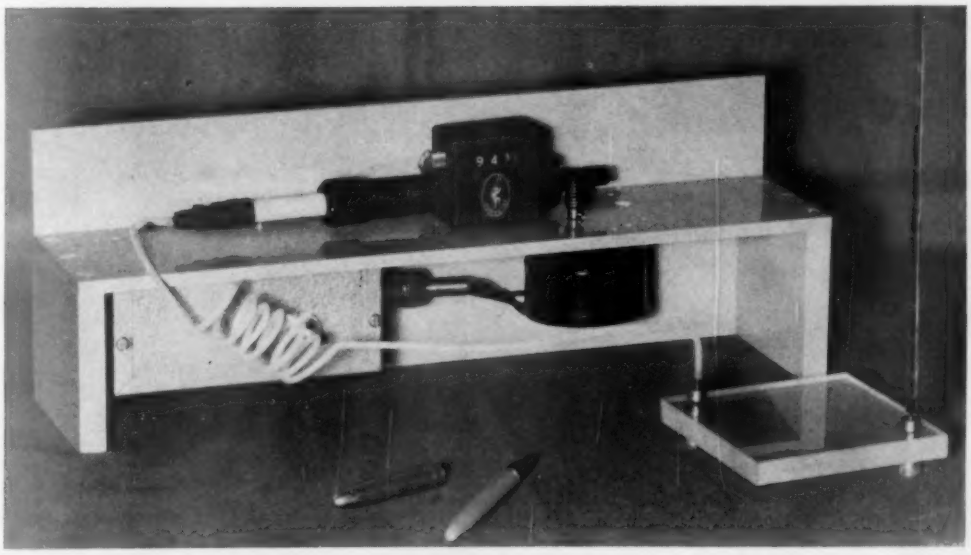
CAPILLARY network in a portion of a micromodel. Fig. 1.

WHAT WE KNOW about multiphase flow through a porous medium is based in part on what we have seen in simple systems such as single capillaries and capilliary doublets.[1 2 3 4]

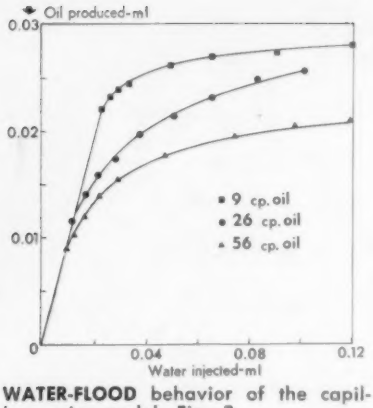
Visual studies in systems of more complex geometry have been made by Chatenever and coworkers.[5 6] They used synthetic flow models consisting of single layers of glass beads between two transparent plates. But it is hard to make detailed observations of interface movements.

To improve on these observations, a capillary micromodel was developed in which fluid movement can be seen in detail. The model possesses many of the over-all characteristics of a reservoir rock, and permits observation of fluid movement from pore to pore.

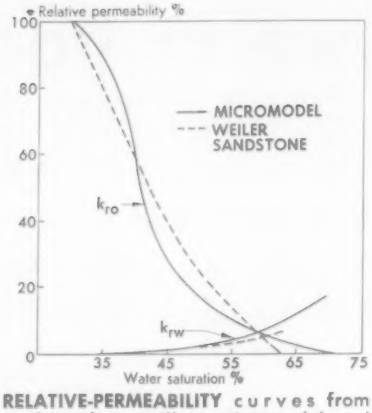
The capillary micromodel is a



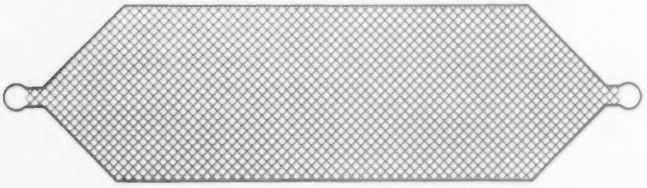
MICROMODEL and auxiliary equipment, including a microburet. Fig. 2.



WATER-FLOOD behavior of the capillary micromodel. Fig. 3.



RELATIVE-PERMEABILITY curves from studies of a capillary micromodel and a natural sandstone. Fig. 5.



LINEAR FLOW is approached in a capillary micromodel of this type. Fig. 4.

network of interconnecting capillary grooves etched into a flat glass plate. A low-magnification view of part of a micromodel showing oil (transparent) and water (dark) is shown in Fig. 1. A typical model contains about 350 horizontal and 350 vertical capillary grooves intersecting at right angles. If each intersection is considered to represent the end of a pore, a model of this size contains the equivalent of about 250,000 individual pores. In cross-section, each capillary is shaped like a shallow V, from 0.0025 to 0.005 in. wide and from 0.008 to 0.0015 in. in depth. The V-shaped capillary grooves taper off to thin wedges on either side, simulating the grain-to-grain contacts of many natural rocks.

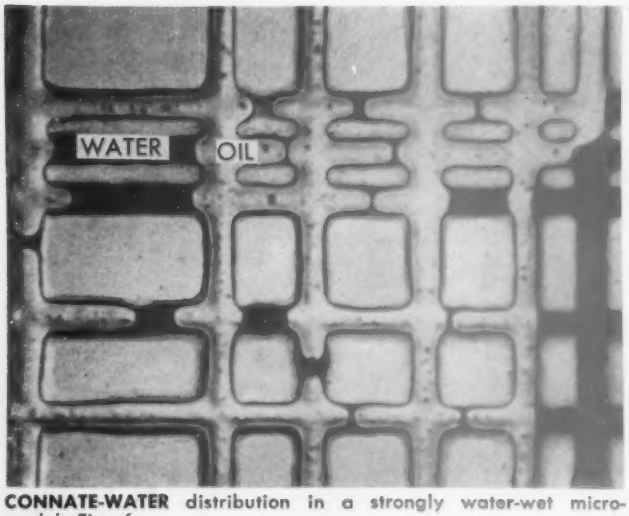
The capillary network is made by coating a glass plate with a thin layer of wax, scribing lines through the wax with a stylus, and then contacting the exposed glass surface with hydrofluoric acid for 1 to 3 minutes. After the wax is removed from the glass plate, a second plate is fused to the first in an annealing oven. Holes which penetrate the capillary network are then drilled through the fused glass plate in any desired pattern. The pore volume of a representative model is about 0.1 ml. The models will hold up to 300 psi. internal pressure without fracturing.

A micromodel and the experimental setup used in tests are shown in Fig. 2. A motor-driven microburet is used as a positive-displacement pump for injecting controlled volumes of fluids. Produced fluid is measured in a capillary pipet attached to producing wells in the model. With this arrangement it is possible to get recovery data during a test with an error of less than 3% of pore volume.

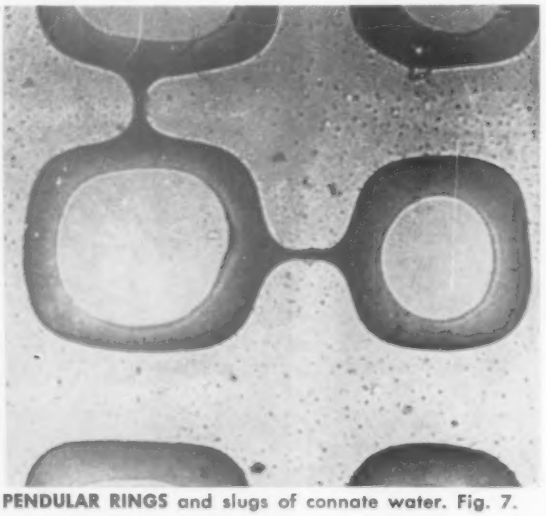
Water-flood behavior curves of the micromodel, Fig. 3, were obtained in floods where flow was essentially linear, Fig. 4. From data such as these the water-oil relative-permeability characteristics of the micromodel can be calculated.[7] The calculated relative-permeability curves are shown in Fig. 5 along with the relative permeability curves obtained on a sample of Weiler sandstone. The relative-permeability functions of the micromodel are quite similar to those of the sandstone core, although the residual-oil saturation in the micromodel is about 5% of pore volume less than that of the Weiler core. Since the behavior of the micromodel is similar to that of the rock, it is probable that the capillary micromodel is a reasonable representation of a natural porous medium.

Static Fluid Distributions Strongly Water-Wet Systems

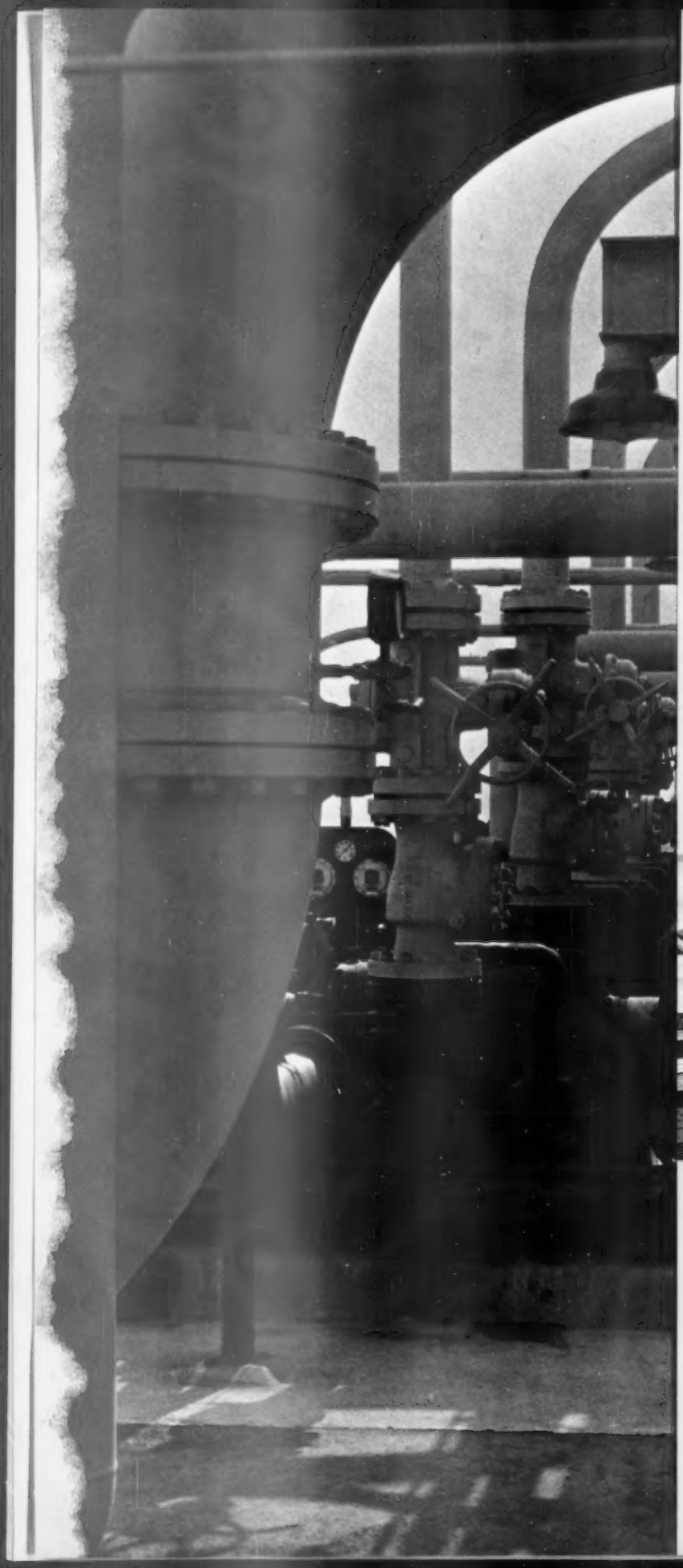
Distribution of connate water in the capillary micromodel is shown in Fig. 6. Connate-water saturation



CONNATE-WATER distribution in a strongly water-wet micromodel. Fig. 6.



PENDULAR RINGS and slugs of connate water. Fig. 7.



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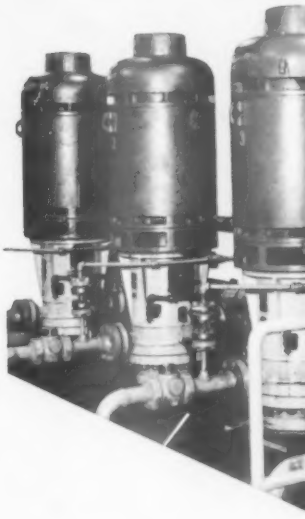

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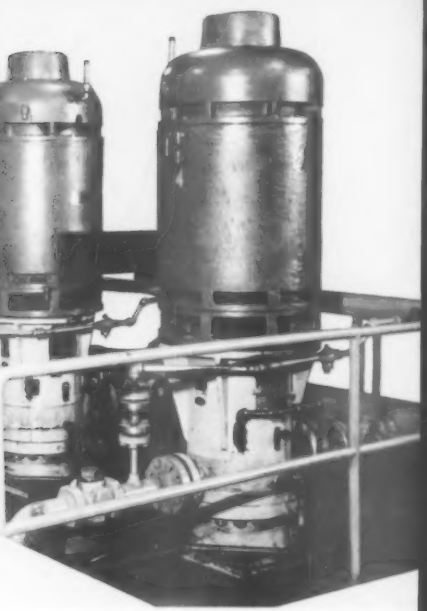

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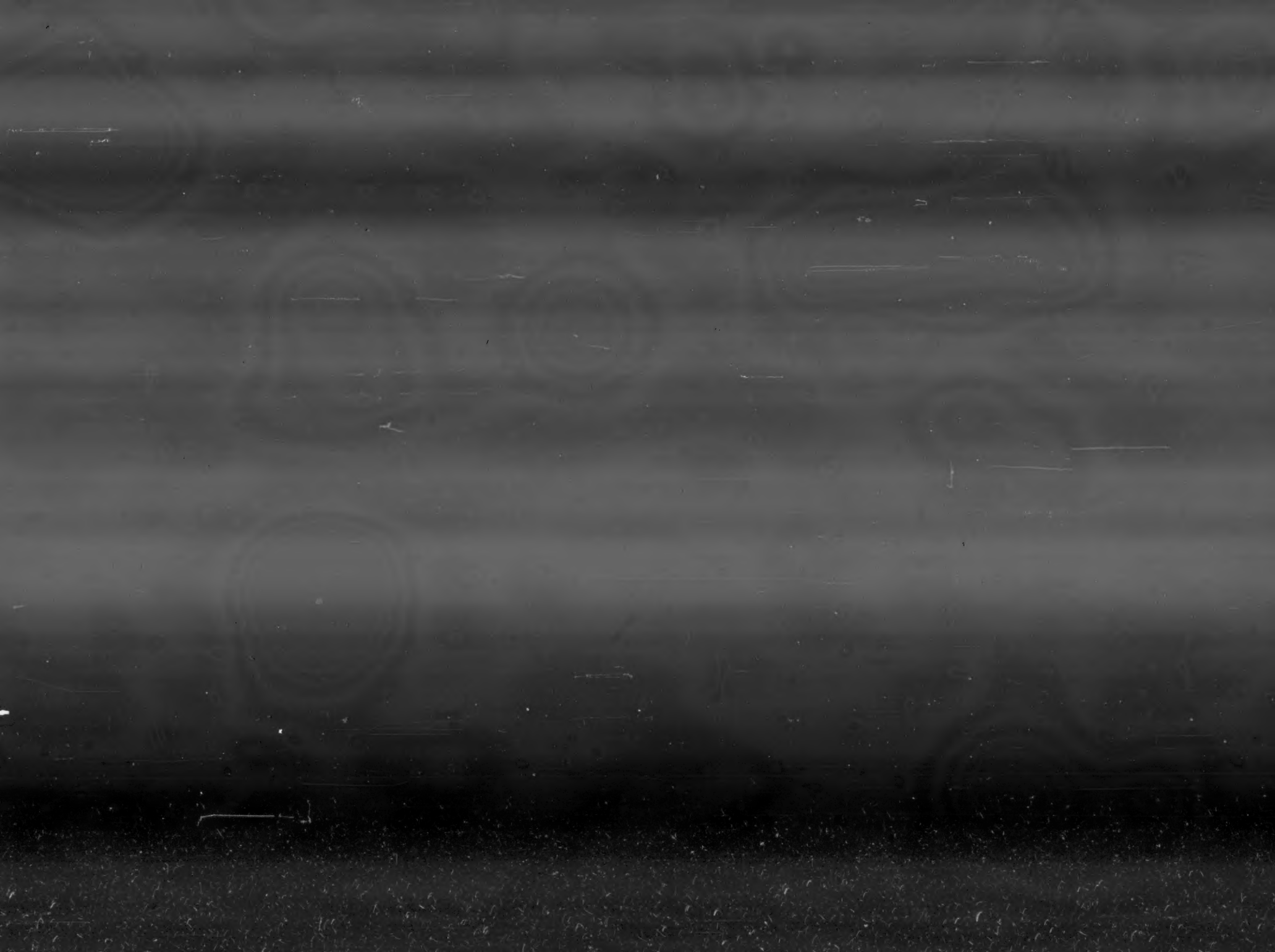
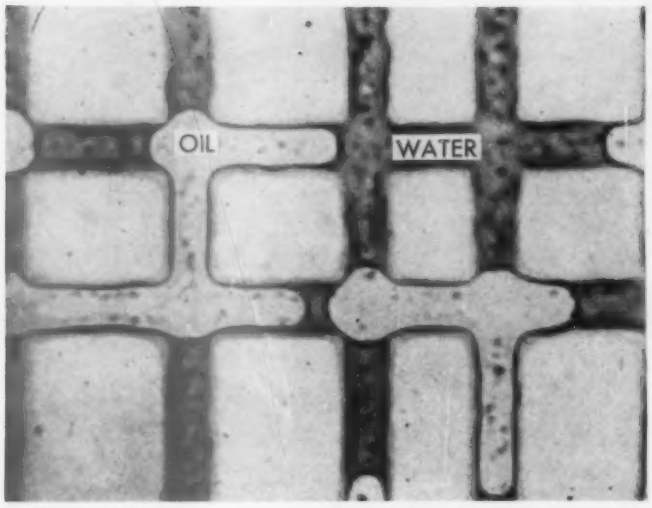
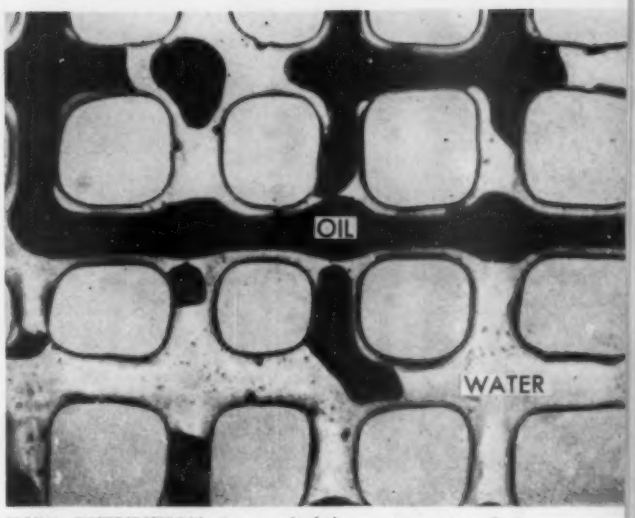




RESIDUAL OIL in a strongly water-wet micromodel. Fig. 8.



FLUID DISTRIBUTION in a slightly water-wet micromodel. Fig. 9.

was established by first saturating the model with water, then flushing with several pore volumes of oil. The water is dark (an inorganic dye had been added) and the oil, which is a refined white oil, is transparent.

Much of the connate water is located at the edges of the V-shaped capillary grooves. This configuration is analogous to the pendular rings observed by Chatenever.[5] Connate water is also found as "slugs" or thin "membranes" which stretch across the pores but do not completely fill them. Fig. 7 is an enlarged photograph showing pendular rings and two of the water slugs. The capillary grooves in this case are wide but shallow and, as a consequence, the pendular rings of water extend for a considerable distance away from the walls of the pores.

Distribution of water and oil at residual-oil saturations in a linear micromodel is shown in Fig. 8. Although this view covers an area of only about 0.004 sq. in., it is representative of the fluid distributions over the entire model. Continuous residual-oil pockets usually extend over very short distances. In most cases the pockets occupy only three or four pores, although infrequently the residual-oil pockets extend over 20 to 30 pores. Very little of the residual oil is in the form of free spherical droplets. These observations are similar to those of Chatenever.[5]

Slightly Water-Wet Systems

There has been considerable speculation during the past few years about the true nature of a slightly water-wet surface. By analogy with work on single crystal faces and in capillary tubes, a slightly water-wet porous medium is often visualized as a medium whose surface has been uniformly altered to increase the angle of contact of the water-oil interface at the rock surface. The model is visualized as having a surface of essentially uniform wettability.

The second explanation of wettability variation considers that the rock surface is heterogeneous. As a consequence of surface heterogeneities, the "wettability" of the rock is a localized characteristic varying from point to point. This explanation forms the basis for the work of Fatt[8] and Holbrook.[9] It is often termed the "Dalmation" or "spotted" wettability concept. Visual evidence of the validity of the concept is shown in Fig. 9. The model was made slightly water-wet by first saturating it with brine and then flushing to connate water with a selected crude oil, after which the fluids were allowed to remain in contact with the model for several hours.

Examination of individual contact angles shows that some areas in the model are strongly water-wet, whereas other areas are strongly oil-wet. In this condition the waterflood behavior and imbibition behavior of the model are similar to those of a natural, slightly water-wet rock sample.[10] Thus, rock surfaces of intermediate wettability are probably mixtures of strongly water-wet and strongly oil-wet surfaces.

Effect of oil-wet surfaces on the size of residual-oil formations is shown in Fig. 10. Residual-oil pockets are usually larger when the micromodel is slightly water-wet than when it is strongly water-wet. However, in either case residual-oil pockets usually extend over only a few pore diameters.

Mechanisms of Water-Oil Displacement

With the capillary micromodel three principal mechanisms of flow have been observed in water-oil displacements. These are:

- Channel flow of oil and water.
- Flow of water through pendular rings into water slugs.
- Flow of oil through oil filaments which connect two or more oil-filled pores.

Channel flow. Oil is displaced primarily by channel flow, both in strongly water-wet and in intermediate wettability systems. In channel flow the water-oil interface moves essentially as a piston. Each fluid moves through its own network of interconnected pores and both flowing phases remain continuous throughout the entire period of oil production. Whenever the oil phase becomes discontinuous, it will remain trapped as residual oil. No migration of the trapped oil pockets can be induced until the water-injection rate is drastically increased. At very high flow rates, however, the oil can be made to break up into isolated slugs or globules, and in this state part or all of the residual oil can be produced. These observa-

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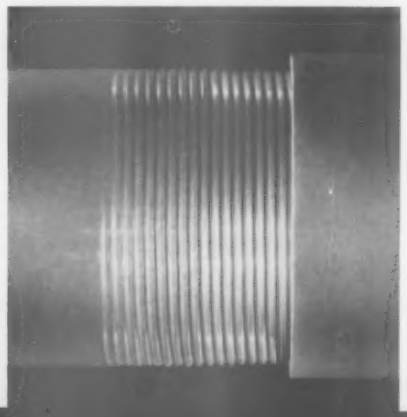

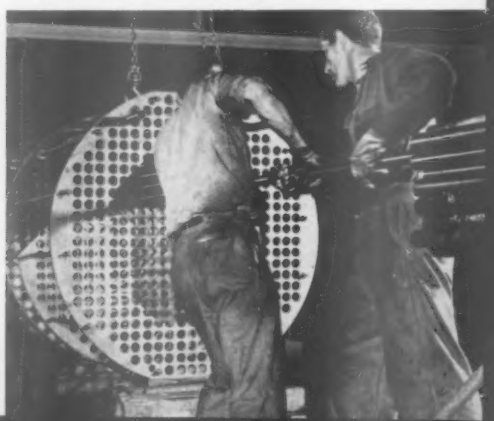

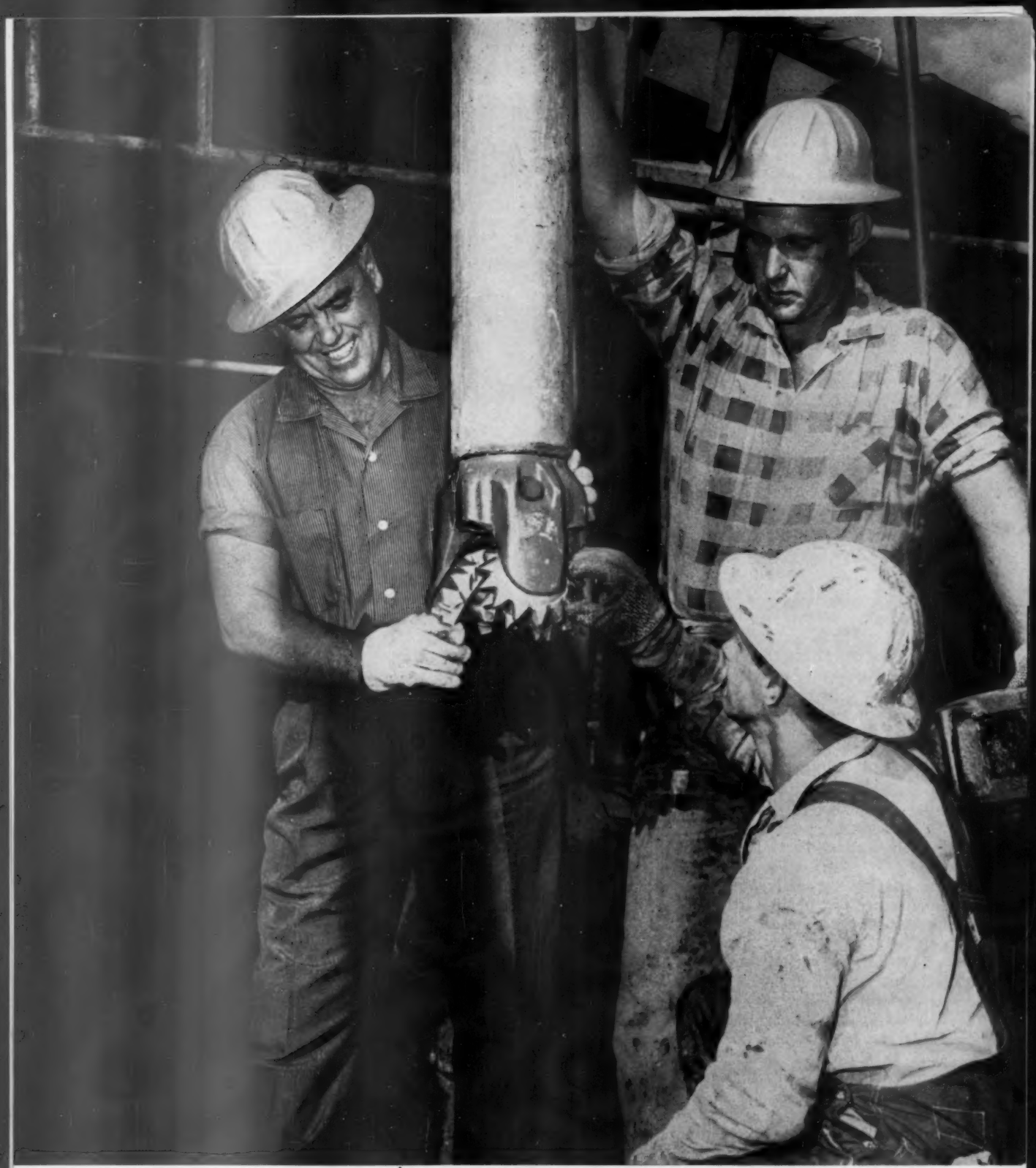

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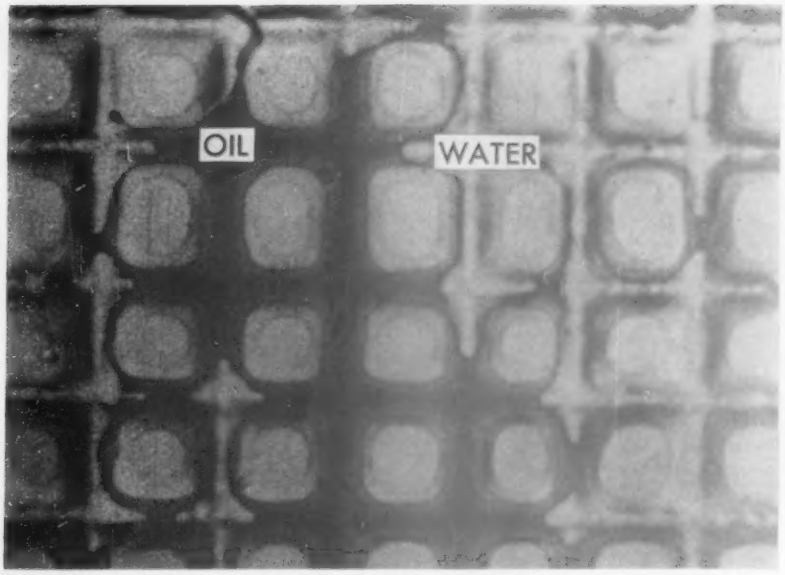


RESIDUAL-OIL POCKET in a slightly oil-wet micromodel. Fig. 10.

tions are consistent with the findings of Chatenever and Calhoun.[5]

Flow of water through pendular rings. As mentioned earlier, some of the connate water in a strongly water-wet system is found as slugs which stretch across pores but do not fill them completely. The water slugs connect two pendular rings of water. It has been observed that water can flow through the pendular rings, causing the water slugs to grow. This is another mechanism for the transport of water in a strongly water-wet system. The mechanism is illustrated in Fig. 11. Fig. 11a shows the advancing water front just before the oil-water interface touches the wall of a pore at point A.

Fig. 11b shows the advancing water after it has contacted the opposite wall of the pore and has imbibed a short distance into pore 1. It can be seen that the water slugs B, C, and D have become slightly enlarged at this stage. It is apparent that the pendular ring of water, E, has served as a flow line between the main water front and the water slugs.

Fig. 11c shows that the size of the water slugs has greatly increased before the water advances into pores 2 and 3. The rate of growth of the water slugs is indicated by the fact than only 2 seconds elapsed between the time photographs a and c were taken. This is conclusive evidence of the mobility of the water in the pendular rings. This mechanism for water movement tends to smooth the water front during a flood, thereby increasing the efficiency of the process.

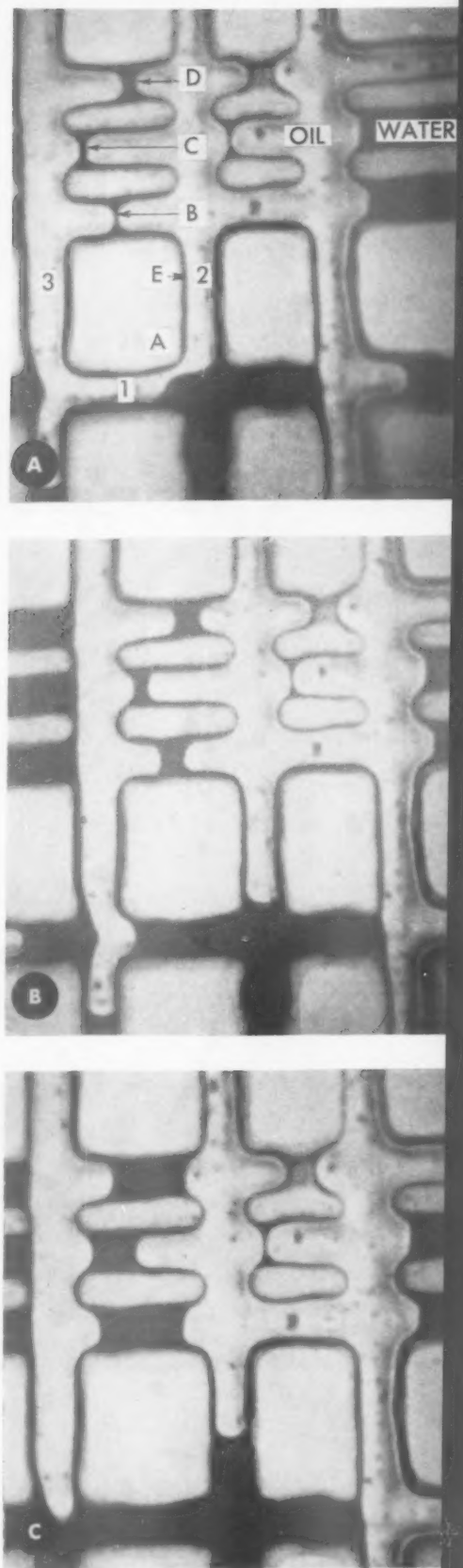
Filament flow of oil. Frequently, in systems of intermediate wettability, oil in pores behind the water front is connected to oil in pores ahead of the water front by thin filaments of oil, Fig. 12. It is probable that the filaments form because parts of the model are oil-wet and, thus, a continuous film of oil "sticks" to one pore wall. Studies using various oils, including refined white oils, indicate that viscous interfacial films are not necessary for filament formation.

As the water flood progresses, oil will flow through the filament and "drain" from the partially trapped oil pocket. Eventually, the filament will rupture and a droplet of residual oil will form. Photographs illustrating this sequence of events are shown in Figs. 12a, b, and c.

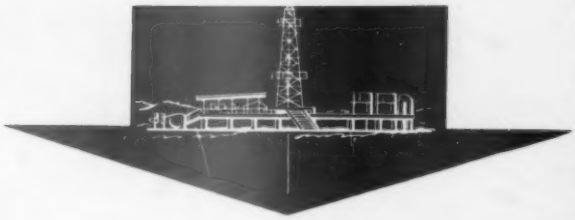
Oil cannot move over long distances by filament flow. However, observations indicate that in slightly water-wet models, moderate volumes of oil move in this way. Filament flow does not occur in strongly water-wet micromodels.

Effect of Wettability on Sweep Efficiency

Sweep efficiency in a water flood of a slightly water-wet micromodel is much lower than that obtained in a strongly water-wet model. Decreased efficiency under slightly



GROWTH OF WATER SLUGS in a strongly water-wet system. Fig. 11.



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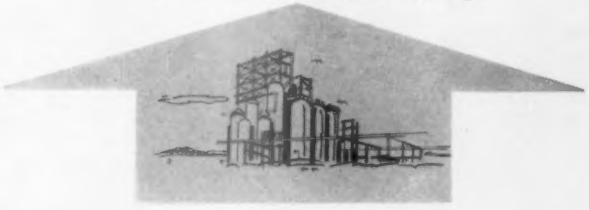

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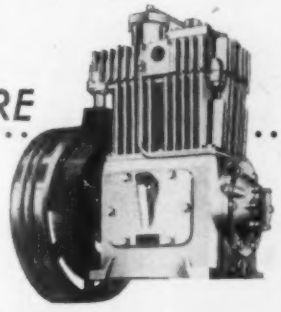

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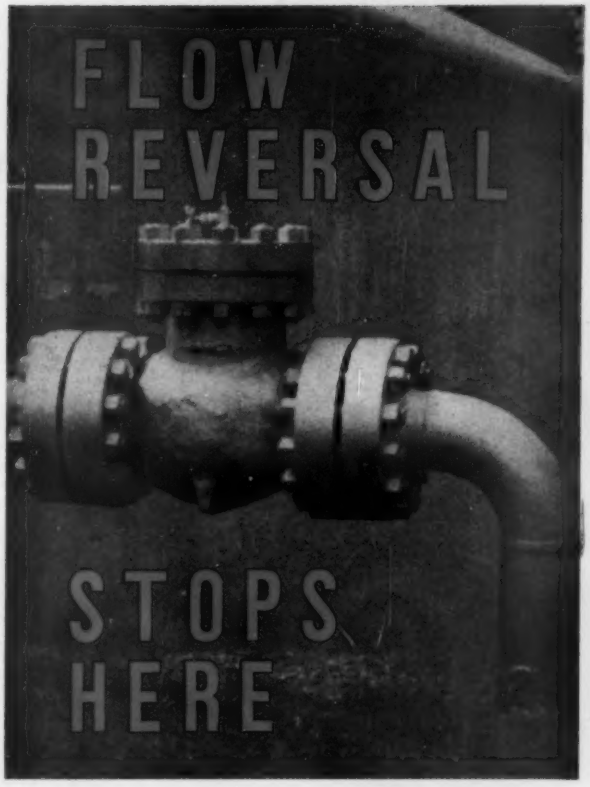

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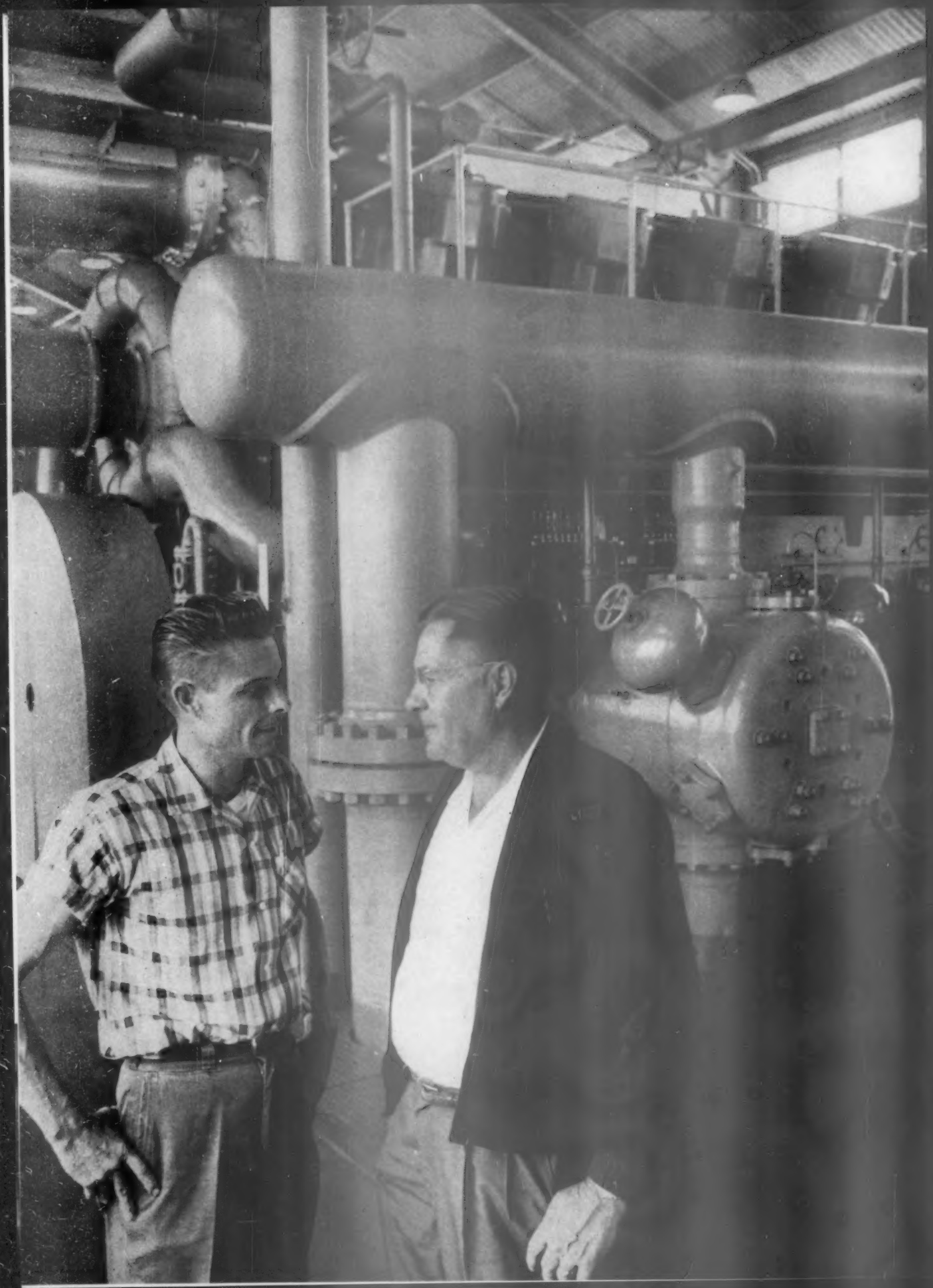

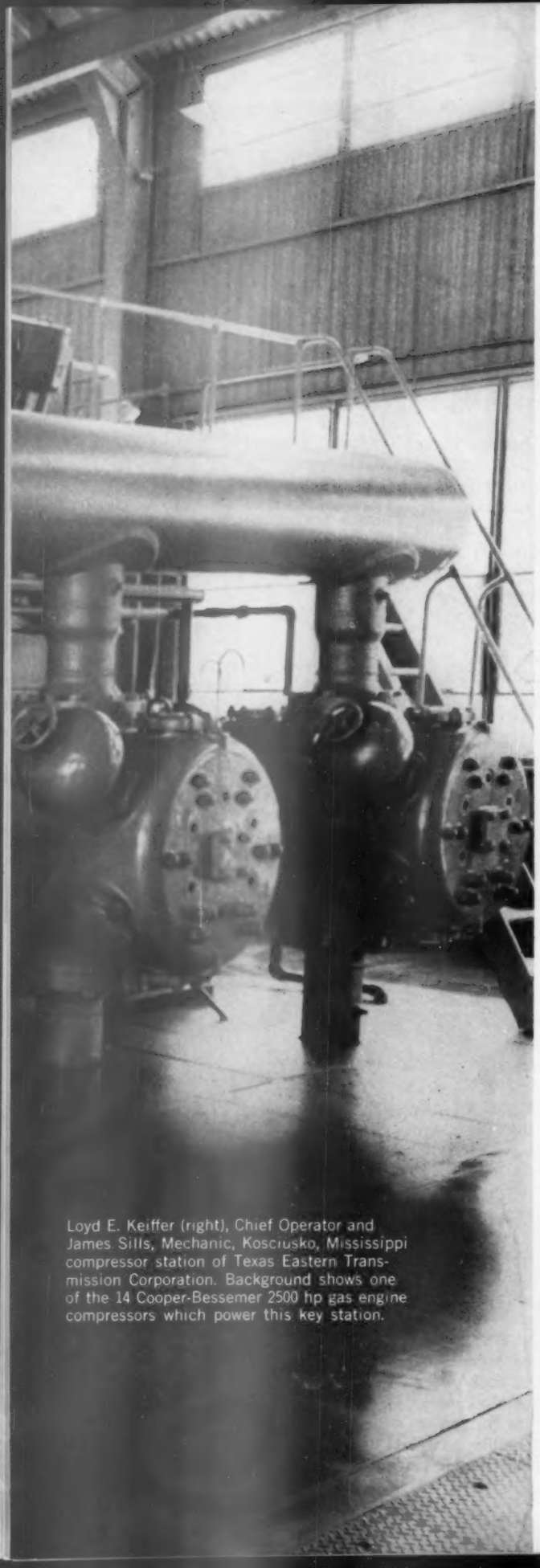

Loyd E. Keiffer (right), Chief Operator and James Sills, Mechanic, Kosciusko, Mississippi compressor station of Texas Eastern Transmission Corporation. Background shows one of the 14 Cooper-Bessemer 2500 hp gas engine compressors which power this key station.

14 C-B compressors handle gas at key Texas Eastern station

The compression job at Kosciusko is a complex one. This compressor station of Texas Eastern Transmission Corporation is supplied gas at three separate suction pressures for its main supply to the northeast. Resultant wide range of operating pressures requires exceptional flexibility and stamina on the part of its compressors.

According to Loyd E. Keiffer, Chief Operator, "Our 14 Cooper-Bessemer compressors do a remarkable job under severe conditions. The various suction pressures range from 475 psi in one supply line to 700 psi in another line. Discharge is 935 psi. The C-B units have given highly satisfactory service under these wide and varying differentials," says Mr. Keiffer.

Kosciusko started up in 1952 with five 2500 hp GMW compressors . . . then added two GMWA . . . then one GMWA . . . then two more GMWA . . . then four GMWA in 1958 . . . a total of 35,000 Cooper-Bessemer horsepower at this key station of Tetco's mainline.

Take advantage of the outstanding advancements of Cooper-Bessemer for compression and power facilities *you* plan. Call our nearest office.

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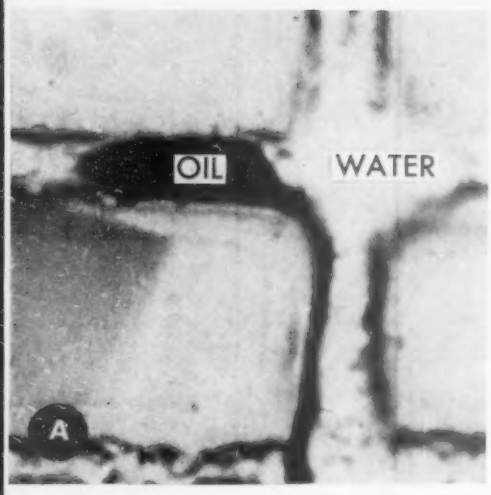
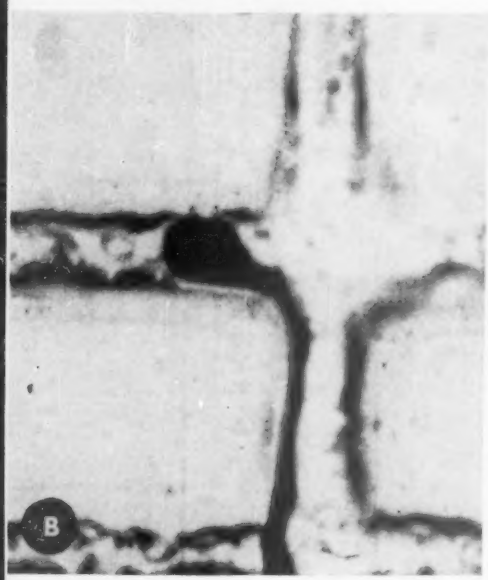
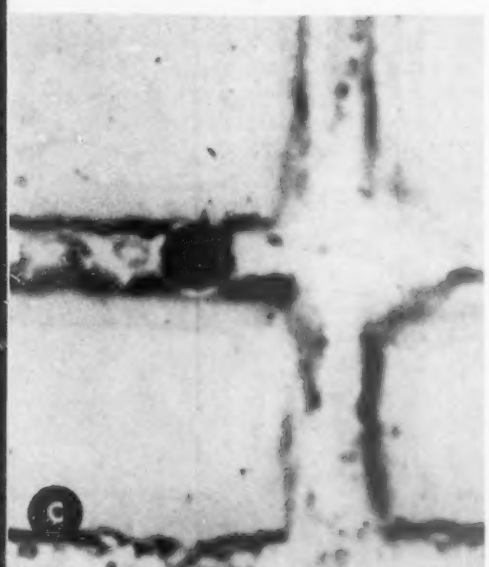






FILAMENT FLOW of oil in a slightly water-wet micromodel. Fig. 12.

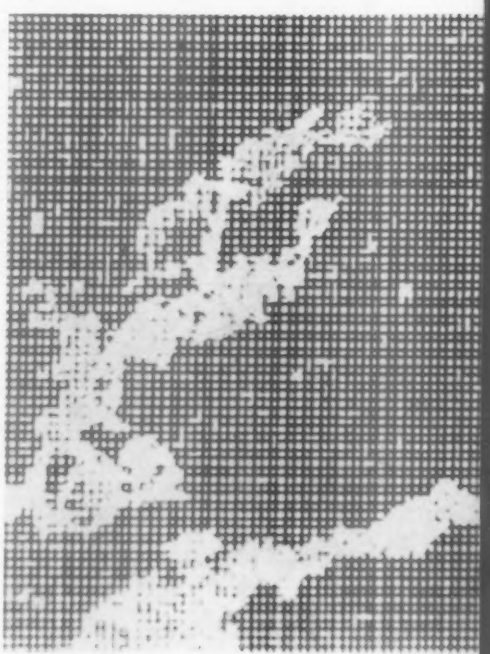
water-wet conditions results from the formation and growth of water "fingers." The initial phase of finger development is shown in Fig. 13. This photograph was taken after the injection of about 2% of pore volume of water in a micromodel containing a Middle East crude oil and connate water. The oil-water viscosity ratio is about 8 to 1. The model in this case represents one-quarter of a five-spot flood pattern. The injection well is at the lower left; the producing well is at the upper right. The length of a finger increases much more rapidly than does its width. This is because water imbibition forces are weak and viscous forces, which favor finger development at this viscosity ratio, are dominant. This effect is further illustrated in Fig. 14, which is an enlarged view of two of the fingers.

Development and growth of water fingers result in an early water breakthrough. Fig. 15 shows that, at water breakthrough, large areas of the slightly water-wet model have not been swept. Thus, to produce the slightly water-wet model to residual oil requires the injection and production of several pore volumes of water.

Areal coverage in a flood of a strongly water-wet model is much more favorable than that shown above. This is because strong capillary forces pull water from the fingers into areas where oil has been bypassed. As a result, finger formation is inhibited and finger growth is retarded.

Figs. 16 and 17 illustrate this point. These photographs were taken during a water flood of a strongly water-wet model containing an 8-cp. white oil. The viscosity ratio was 8 to 1, the same as in the slightly water-wet flood. The model used in this test contained two areas of high permeability (the dotted areas in Fig. 16) which were not present in the model used in the slightly water-wet flood. The high-permeability areas were introduced to encourage finger formation and more clearly illustrate the benefits of strong imbibition forces on areal coverage. Fig. 16 shows the model after the injection of 6% of pore volume of water. (The water is the dark phase in the photographs.) At this stage a large water finger has formed in one of the high-permeability areas. Otherwise, however, the model is

FINGER FORMATION in a water flood of a slightly water-wet micromodel. Fig. 13.



FINGERS from Fig. 13 are enlarged in this view. Fig. 14.

AREAL COVERAGE at water breakthrough in a slightly water-wet micromodel. Fig. 15.

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Finger-Tip Adjustments

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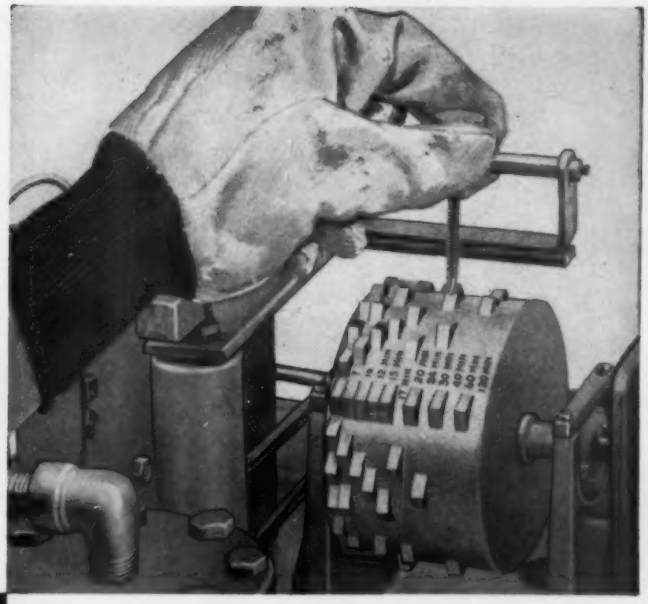

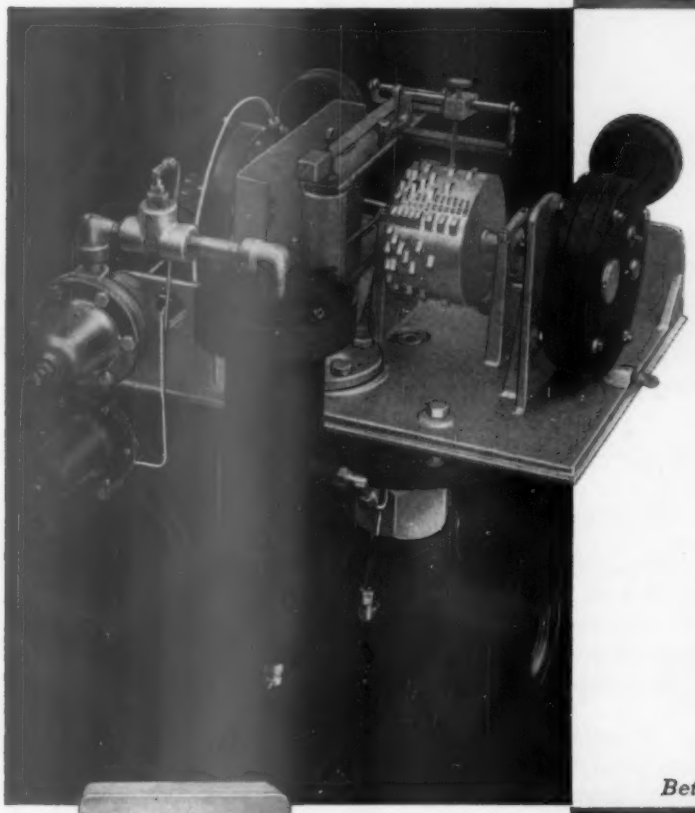

Here's a real *oil field tool.* A rugged, long lasting intermitter-regulator for gas lift, which can be accurately set by a field man *with his gloves on*.. no special tools needed.

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Select a time cycle by moving the adjusting screw along the slide bar until it lines up with the desired time embossed on the drum. Then set the injection time by turning the adjusting screw. Turning right increases.. left decreases.

Cycle frequencies are possible from an every five minute maximum to a minimum of one injection per revolution of the two-hour clock. Each cycle repeats with reliable accuracy.

For use as a pressure regulator, back off the adjusting screw until it clears timer drum tabs. Set to hold desired pressure with adjusting knob on the bourdon tube. It's as simple as that.

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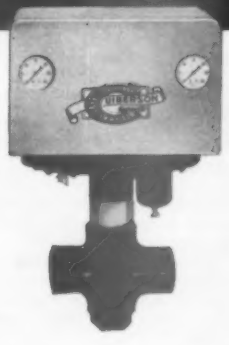

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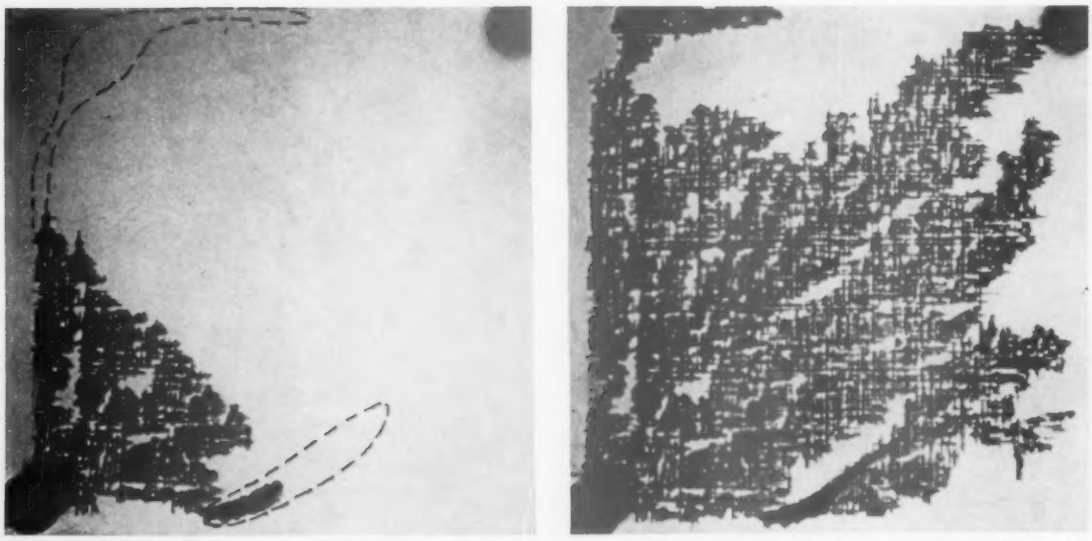

AREAL COVERAGE in a strongly water-wet micromodel is shown when injected water amounted to 6% of the pore volume, Fig. 16, left, and at water breakthrough, Fig. 17, right. The dotted lines of Fig. 16 enclose two high-permeability areas.

being very efficiently swept by water.

Coverage at water breakthrough is shown in Fig. 17. Note that the finger shown in Fig. 16 has disappeared, although some oil near this finger has been trapped and cannot be recovered. Water has now fingered through the second high-permeability area and, also, through the center of the pattern. For the most part, however, efficient coverage of the model has been obtained at water breakthrough.

It is apparent that reduced water-wetness of the reservoir rock will result in decreased flooding efficiency, not only because of an unfavorable effect on relative permeabilities, but also because areal coverage is severely reduced.

Acknowledgment

The authors express appreciation to Jersey Production Research Co. for permission to publish this article. Part of the work was sponsored by Arabian American Oil Co., whose participation is gratefully acknowledged.

The authors conclude . . .

1. The similarity between the relative-permeability functions of the micromodel and those of natural rock indicates that the model is a reasonable representation of natural porous media. Comparison of the water-flood performance of the micromodel and rocks under various wettability conditions supports this general conclusion.

2. Reservoir rock surfaces of intermediate wettability are probably mixtures of strongly water-wet and strongly oil-wet surfaces. The oil-wet surfaces promote water fingering and reduce the efficiency of a water-oil displacement process.

3. Channel flow of oil and water is the principal flow mechanism in both strongly water-wet and intermediate wettability systems.

4. Flow of water through pendular rings is a second mechanism for water movement in strongly water-wet media. This type of water movement helps to smooth the flood front in a water flood, reducing the severity of water fingering.

5. Noticeable volumes of oil move through oil filaments in rocks of intermediate wettability.

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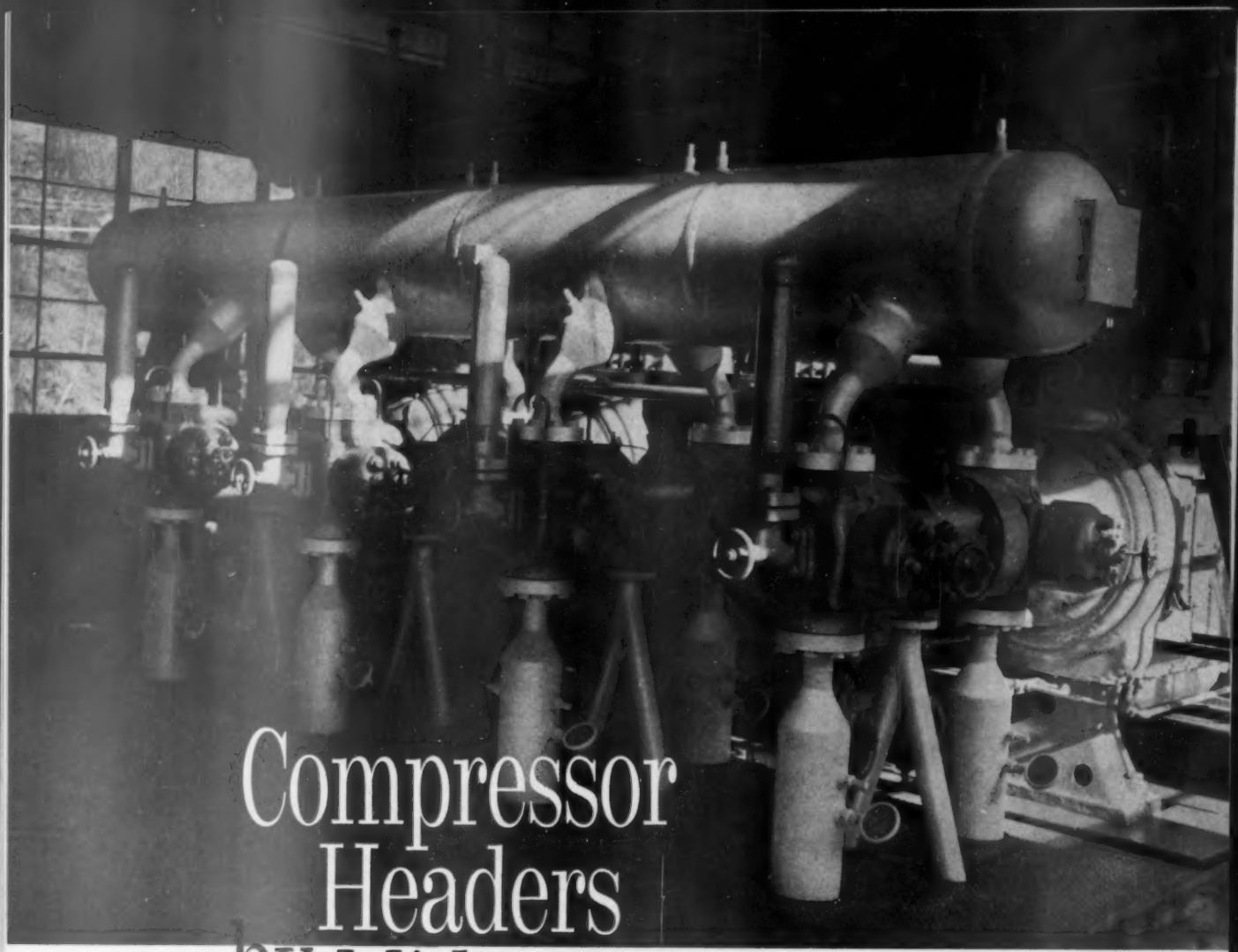
Film available

Some of the figures in this article are clipped from a motion picture that Jersey engineers have made of the micromodel in action. This film is available for loan by writing to Dr. R. N. Meinert, Jersey Production Research Co., 1133 North Lewis, Tulsa, Okla.



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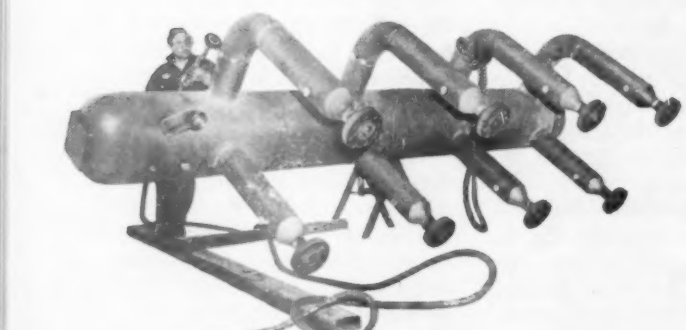

These compressor headers, fabricated for United Fuel Gas Company's compressor station at Coco, W. Va., are typical of the precision and quality of Midwest workmanship.

Upper header, formed of 24" O. D. x 1¾" thick rolled and welded Grade B carbon steel plate, has eight 8" extruded outlets reducing to 3" 1500 lb. flanged ends, and one 8" and one 3" full-size flanged outlets.

Lower header, of same diameter and wall thickness, contains eight 8" extruded outlets reducing to 3" 1500 lb. flanged ends, one 4" outlet, plus a 24" x 6" extruded cap.

This station, operating at 2000 lb. pressure, comprises five 880 HP and one 1100 HP gas engine compressors.

Midwest can produce headers to your exact specifications, in either welded or extruded type, and will gladly offer assistance on manufacturing and metallurgical problems.

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Crossing agreements should serve mutual ends

Methods are available for pipelines to forestall unreasonable demands by railroads

BY B. Z. KASTLER, JR.
Mountain Fuel Supply Co.

RAILWAYS were built before the pipeline industry really came into its own. Rail networks honeycomb the nation and must be crossed by other modes of communication and transportation so the maximum public benefit might be realized. Otherwise, railroads would remain virtually the sole means of transport.

Crossing railways presents problems to all concerned. The railroad wants the crossing to be made and maintained safely, without disrupting rail service. The pipeline wants the line to be safely installed with operation and maintenance of the pipeline uninterrupted. Both have investment at stake, an investment which ultimately affects ability to serve the public at competitive prices. Both wish to protect their investment.

Prior rights. The problem arises because the railways were "there first" and have a property interest in their right-of-way. They have been able to accomplish their ends by dictating the terms to pipelines. These terms generally fall into two categories:

1. Fixing the physical or engineering specifications of crossings, and
2. Defining the nature of the privilege given to the pipeline and fixing the liabilities of the parties.

Problems have arisen in the first group where specifications are felt to be unreasonable or unjustified.

Presented at 1961 AGA Transmission Conference.

The second group, however, has the more basic problems. The railways have largely been unwilling to grant permanent rights to pipelines to occupy railroad property for crossing purposes, but allow only permissive "licenses" revocable by the railroads without cause. This is true even though very heavy investment which should command better protection is often involved.

Restrictive licenses. Licenses are often issued for short periods at rentals of even shorter interval. This involves constant renewals and unnecessary accounting and detail work by both parties—all of which adds to the cost.

The license often endeavors to fix unreasonable "liability" upon the pipeline, adding high insurance costs to its owner. This often requires the pipeline to absolve the railroad from damage arising from the mere existence of the pipeline—even though some calamity, crank, or the railroad itself injures the pipeline and causes it to damage something else or hurt some person.

This is a typical liability provision in such a license:

"The licensee shall indemnify and hold harmless the railroad company from and against any and all liability, loss, damage, claims, demands, costs and expenses of whatsoever nature, including court costs and attorneys' fees, which may result from injuries to or death of persons whomsoever or damage to, loss or destruction of property whatsoever (including damage to the roadbed, tracks, equipment or other property of the railroad company or property in its care or custody), when such injury, death, loss, destruction or damage grows out of or arises from the bursting of or leaks in the pipe line, or the explosion or ignition of gas carried therein or escaping therefrom, or in any other way whatsoever is due to, or arises because of, the existence of the pipe line, or the construction, maintenance, operation, repair, renewal, modification, reconstruction, revision, relocation or removal of said pipe line, or any part thereof, or to the contents therein or therefrom. And the licensee does hereby release the railroad company from all liability for damages on account of injury to the pipe line from any cause whatsoever."

High premiums. The pipeline here must release the railroad from liability for damages the railroad itself might do to the pipeline. Insurance companies are reluctant to underwrite such wide-open liability without higher premiums.

Some lines have required not only the pipeline company, but also any contractor, to fully insure the above liability obligations, at substantially higher premiums.

More recognition should be given to the right of pipelines to "coexist" with railways. It should first be attempted by peaceful means. Top ex-

ecutives of the industry associations involved might well confer on mutually acceptable crossing "specifications" as well as terms which fairly and reasonably recognize and protect the investment and rights of both. The pipelines should not, just because they came later, be compelled to shoulder all risks.

Other resorts. If such peaceful coexistence cannot be achieved, pipelines must look elsewhere for aid. Much is available.

Laws of most states permit one "utility" or "public use" to condemn rights from another. Courts have permitted condemnation of property devoted to a public use where it will not materially impair or interfere with the existing use. In addition, federal laws offer some assistance if the operation is interstate or arises on federal property. For example, interstate gas pipelines holding FPC certificates of public convenience and necessity have, under the Natural Gas Act, the right of condemnation in U. S. courts.

Such laws are a useful and swift tool. Most condemnation statutes provide for "immediate occupancy" and leave price determination to a later time. This avoids undue court delays. Rights of a permanent nature can thus be obtained, removing the fear of cancelation and the bother with rentals and expiration dates. The court will not fasten unreasonable liability upon either the railway or the pipeline, but will leave the parties responsible only for their own neglect. A court will not require adherence to unreasonable specifications although the pipeline will have to adhere to a high standard of skill and care in making the crossing and will generally not be permitted to interfere with railroad uses of the property.

Share burdens. In several states the Public Service Commission or a similar body has jurisdiction over cases involving crossing by one carrier of the facilities of another.

These agencies, like the courts, will not insist that one party bear all of the burdens. In North Carolina Natural Gas Corp. et al. vs. Seaboard Air Railroad Co., decided December 8, 1960, the North Carolina Utilities Commission permitted a gas-pipeline crossing and assessed the charge at $75.00. The commission held the pipeline responsible for its own negligence only and refused to require it to pay for future periodic railway inspections. The Commission stated:

"It is not the Commission's intention . . . to relieve the respective gas companies of their obligation . . . to provide full and complete maintenance of their respective pipe lines nor of their liability for any damages to Seaboard by reason of their own negligence. We note in passing that if Seaboard's contentions here were upheld, it would be very much in the interest of Seaboard to have its entire right-of-way interlaced with pipe lines so that other parties would then bear the expense heretofore borne by Seaboard of providing the periodic inspections and repairs which are always necessary."

If a company cannot get a satisfactory agreement from a railway, condemn, nor look to a regulatory agency for aid, then it must seek

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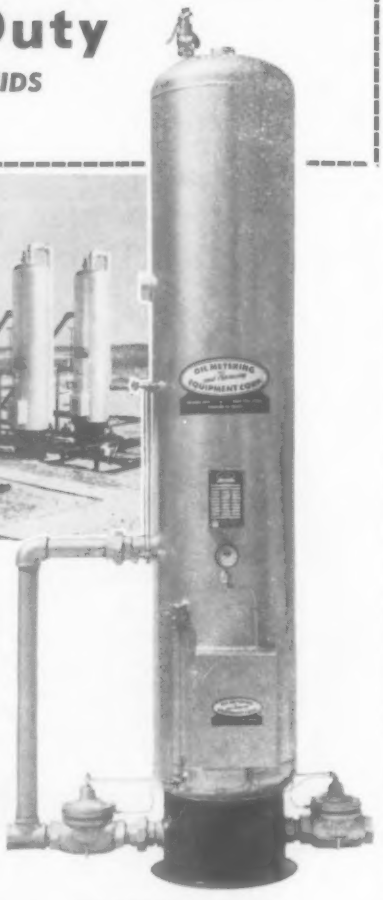

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modifications of law. This means an appeal to the legislature for amendment of Eminent Domain or utilities statutes. The case would probably receive sympathetic attention if well prepared since it would simply seek aid to perform a public service.

Cities Service adds facilities

THREE new compressor stations and the modernization of several older ones are included in the capital expenditure budget of Cities Service Gas Co. for 1961. Cities operates a 6,800-mile system.

Major single step in the 1961 program is the addition of 12 new compressor engines totaling 22,500 hp. These new engines are going into three new compressor stations as additions to existing facilities.

The three new stations scheduled for 1961 completion are Americus station northwest of Emporia, Kan., Marion station, northwest of Marion, Kans., and a single-engine booster station on the site of Hugoton station. The new Hugoton engine will be equipped to operate unattended.

Americus station is designed to use three 2,000-hp. engines similar to the Montezuma and Stafford stations that were completed in 1960. It has a 30-acre site. It will provide additional capacity on the 26-in. main line from Hugoton to Kansas City.

Marion station will ultimately have three 1,800-hp. engines to pump gas through a 10-mile, 8-in. line to the Hugoton 26-in. main line. The other engines, all new vertical units, will go into existing stations on the Hugoton line.

Modernization of older stations including Pampa, Welda, Grabham, Ottawa, Corwin, and Matfield is part of the program. Automatic oiling, lubrication, temperature, and pressure controls will be added.

Pipeline construction is part of the program, much of it replacement. Eight miles of the 10-in. Springfield line will be replaced with 16-in., 2 miles of the 12-in. Rangeline line near Joplin with 16-in. and 5 miles of the Neosho 4-in. line with 8-in. The 10-mile, 8-in. line from Marion station to the Hugoton main line is included.

NEWS FROM DOWN THE LINE!

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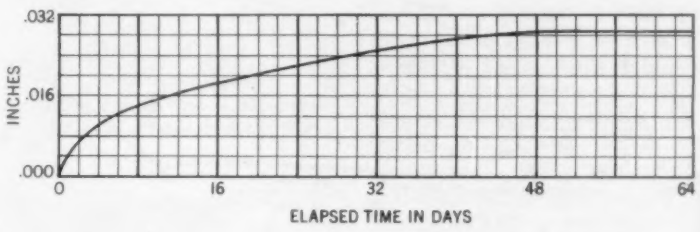
They're not alike, not in physical properties! When plastic insulators first became available for pipeline use, WmSON felt they were inferior to the steel and block types then available. We delayed our entry into the field until we could provide a plastic material to withstand field abuse and wear. We found that material in a high density polyethylene which could be injection molded to provide low cost insulators of the highest quality.

Our decision has proved sound. Breakage and excessive wear of glass fibre reinforced plastics, particularly in large sizes, has created a lack of confidence in plastics in general, but the M-2 Plastic THINsulator® has proved its stamina. Its high resistance to cold flow has been proved. Deflection test results: 1000 p.s.i. on each THINsulator runner for 64 days — total cumulative deflection only 0.029". Max. temp. during test, 105° F., min. temp., 75° F.



Its low coefficient of friction causes it to slide easily inside casing. The M-2 is completely resistant to impact fracture (4.0 ft. lbs./in. notched) and has successfully worked on 36" pipe, ½" wall, pulled in excess of 500 feet. We are convinced that it will perform as well or better than any other insulator on the market, including all known steel types. Other physical properties: *Dielectric strength* — (short time, ⅛" thickness) 500 volts per .001 inches (D149-55T); *Tensile strength* — 4400 p.s.i. at 20 in./min.; *Elongation* — 25% 20 in./min.; *Abrasion resistance* — Taber index 5.7.

The increased acceptance of the M-2 THINsulator has brought production to a level of real economy in injection molding. These cost savings are being reflected in new WmSON prices for 1961.

In planning '61 cased crossings, don't pay a premium for other insulators — use WmSON engineered M-2's and save!

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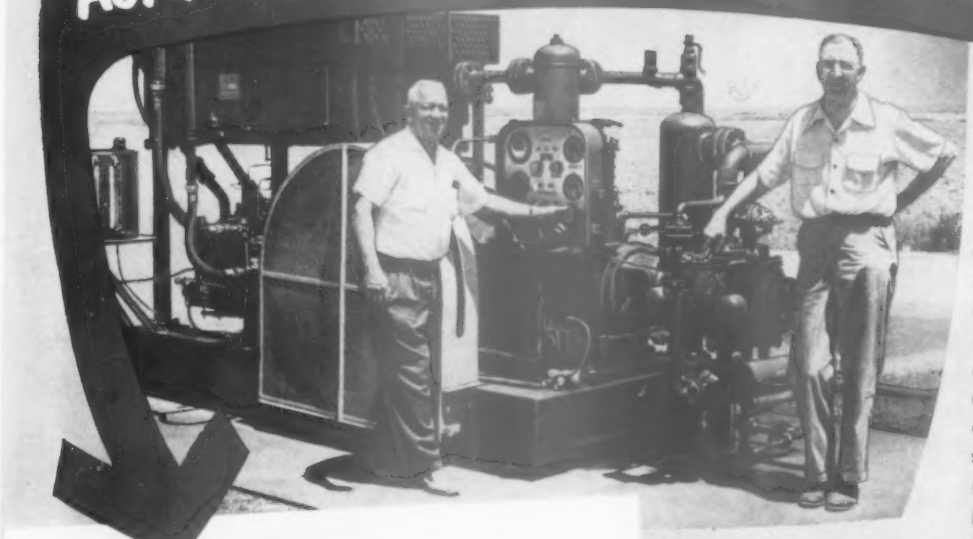


Two of Mr. Payne's happy customers: Clyde Allison (left) and L. F. (Lou) Andersen, independent oil field production service operators, Co-owners of A & A Production Service Co. (Glenn, Calif.)

PAYNE OILFIELD EQUIPMENT LEASING COMPANY

3851 LONG BEACH BOULEVARD • LONG BEACH 7, CALIFORNIA
TELEPHONE: GArfield 61453

June 5, 1961

Mr. John Rudolph
Vice President
Ajax Iron Works
Corry, Pennsylvania

Dear John:

In the leasing of gas compressors [illegible] We are repeatedly reordering your Ajax DPC-60 compressor for service to our Northern California customers for boosting at the well site gas produced from [illegible] as to meet pipeline pressures.

The qualities we find in this equipment most important are as follows:

Low maintenance and operating cost.

Reliable and dependable service under continuous operation.

Compact and portable construction.

Economic installation and re-installation expense plus every reasonable device for safe operation under unattended operating conditions frequently remote from habitation.

Mufflers used in connection with these operations have reduced the noise level to a point whereby there is no problem even though the installation is adjacent to habitation.

[illegible] the operating personnel in the field are most enthusiastic about this piece of equipment and hence, as any businessman would know, it gets the best of attention as a result of that attitude.

Yours very truly,

PAYNE OILFIELD EQUIPMENT LEASING CO.

W. S. Payne, Jr.

"We are repeatedly re-ordering your Ajax DPC-60 compressor for service to our . . . customers for boosting at the well site . . ."

". . . the operating personnel in the field are most enthusiastic about this piece of equipment and hence, as any businessman would know, it gets the best of attention as a result of that attitude . . ."

Whether buying or leasing equipment, specify Ajax compressors, engines, and pumps. Proved economy, performance, and low maintenance costs. Units designed for extended non-attendant operation and matched to do your specific job.

AJAX

ALWAYS A FULL DOLLAR'S VALUE IN AJAX PRODUCTS

AJAX COMPRESSORS

ALSO BUILDERS OF

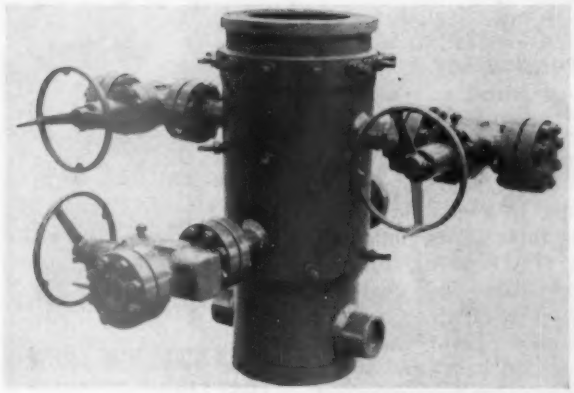
ENGINES PUMPS

AJAX IRON WORKS CORRY, PENNSYLVANIA

Oil Field Distributors

- The National Supply Co. — Pittsburgh, Pennsylvania
- Bethlehem Steel Co. — Supply Division, Tulsa, Oklahoma
- Mid-Continent Supply Co. — Fort Worth, Texas

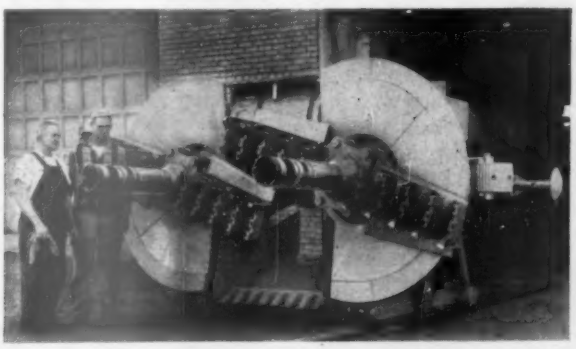
Want more facts about equipment or copies of product literature described in this issue?
Send this coupon
to manufacturer at address shown after each item.
Product name, Model no., literature title or number: _____
_____
Described in OIL AND GAS JOURNAL-issue of October 16, 1961
NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____



Compact casing head developed

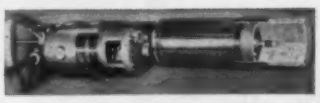
THIS casing head has been developed to be used in place of two or more casing heads and the tubing head of a conventional wellhead hookup. As an example, where 13⅜, 9⅝, and 5½-in. casing and 2-in. tubing are planned, the head is attached to the 13⅜-in. casing, and the 12-in. blowout preventer is flanged to it. The 9⅝ and 5½-in. casing and the 2-in. tubing are successively landed and packed off in the compact head.

Side outlets from the head connect with each casing string. The 12-in. preventer is not removed until the operator is ready to flange the christmas tree to the head. Compared with older casing heads, the new head is claimed to speed up drilling and completion and to eliminate the usual flanged joints which are possible sources of leaks, when conventional casing heads are used. Source: **Cameron Iron Works, Inc.,** Box 1212, Houston, Tex.



"Big-hole" drilling machine

A NEW boring technique, called the Alkirk Pilot-Pull principle, has been applied to a machine which may have application for drilling large-diameter vertical holes in the search for oil and gas. The machine operates on a pilot-pull principle and literally pulls itself forward into the material being bored by means of force exerted against a pilot



which is anchored in the material ahead of the machine.

Machines incorporating the pilot-pull idea can be designed to accomplish almost any hole-making function, the developer says. Compared with present drilling equipment, the machines are claimed to provide a faster method of boring large-diameter holes in hard substances. They require no external bracing or support, permit boring at any angle, including the vertical, and are self-propelled, pulling themselves forward on their anchored pilot. Source: **Alkirk Corp.,** 7911 10th Ave. South, Seattle 8, Wash.

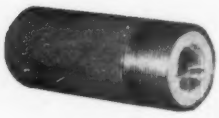
●

Digital scanner-converter

A remote digital output is provided by this new Discon digital scanner and converter which can be used to "read" dial and pointer instruments, gages, and meters.

Accuracy and resolution of the instrument are reported to be 1 part in 10,000. Instrument dials with diameters from 3 to 20 in. can be

production and maintenance problems solved with Inhibited Acid



BEFORE CLEANING

AFTER CLEANING

Dowell inhibited hydrochloric acid is an efficient, economical solvent and cleaning solution. It is low in cost when its cleaning capacity is considered. One hundred gallons of 15 per cent hydrochloric acid will dissolve up to 184 pounds (one cubic foot) of pure limestone or calcium carbonate. It is ideally-suited to do-it-yourself operations.

Dowell hydrochloric acid has many uses. Some of them are: to improve production from old dolomitic or limestone wells; to remove scale and "gyp" from the face of producing formations, tubing and lead lines; to clean disposal or input wells; and to descale engine cooling systems, heat exchangers, boilers, valves, fittings, nipples, etc.

Dowell inhibited hydrochloric acid is available in small or large quantities from any Dowell station. Ask a Dowell representative for application information.

PRODUCTS FOR THE OIL INDUSTRY

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

accommodated. Operated photoelectrically, the scanner unit "bridges" the existing instrument dial and mounts outside the instrument flange. Source: **MacLeod Instrument Corp.,** 4250 N.W. 10th Ave., Fort Lauderdale, Fla.

•

New antennas for two-way radios

Folded coaxial-design base-station antennas for 136-174 mc. two-way radio systems are available in a new line comprising three series: unidirectional (TAD 6070), cardoid (TAD 6080), and unidirectional (TAD 6090).

All three basic units use a center-fed half-wave design with a folded radiating element and a coaxial skirt section. This design is claimed to eliminate projecting ground-place rods which, in turn, simplifies installation, reduces pattern distortion, and minimizes ice damage in cold climates. Parasitic elements are used to provide specialized radiation patterns in the cardioid and unidirectional series. Source: **Motorola Inc.,** 4501 W. Augusta Blvd., Chicago 51, Ill.

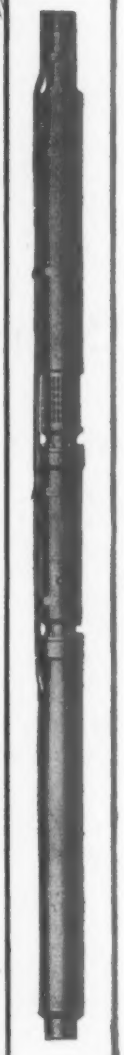
•

Instrument tests water purity

Dissolved oxygen in boiler and process-steam water can be continuously measured with a new instrument, called the Do-100 continuous dissolved-oxygen analyzer. The instrument can detect an oxygen change as small as 0.1 part per billion.

Dissolved oxygen reacts with measuring electrodes in a sampling cell. An electric current proportional to the amount of oxygen in a continuous sample is generated. This current operates an indicator calibrated from 0 to 25 or 0 to 250 parts per billion. A signal from the indicator may be transmitted to any conventonal millivolt recorder. Source: **Wallace & Tiernan Inc.,** 25 Main, Belleville 9, N. J.

INCREASE PROFITS WITH REDA Submergible PUMPS



REDA GIVES YOU THESE COST SAVING FEATURES AND DOES THE JOB BETTER!

- Lower cost for installation, operation and maintenance.
- 250 to 18,000 BPD capacities
- Depths to 10,000 ft.
- Corrosion-resistant construction
- Long life — dependable service
- A complete line to meet pumping requirements

and

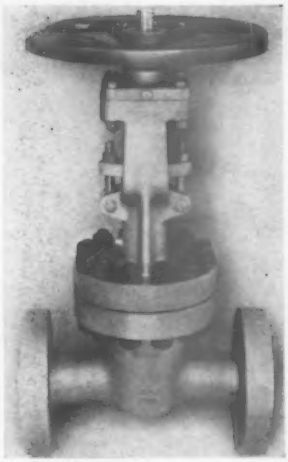
INVESTMENT COST IS FAR LOWER WHEN YOU CHOOSE REDA FOR YOUR PUMPING NEEDS.

Write or call for more information. Reda engineers will be pleased to assist and help plan your operations.

SIGN OF QUALITY SUBMERGIBLE REDA PUMPS

REDA PUMP CO.
BARTLESVILLE, OKLAHOMA

Manufacturers of submergible motors and pumps for over 35 years — for oil, brine and water wells, gasoline and jet fuel



Corrosion-resistant valves

Where corrosion is a problem in refineries and petrochemical plants, a new line of valves may solve the problem. Designed for use with reactive hydrocarbons and chemicals, the valves come in globe, Y-type, and lift-check models with an ASA 1,500-lb. rating. The materials of construction may be any of a variety of corrosion-resistant metals.

Valve ends may be flanged or butt-weld. The globe and lift-check valves come in ½ to 4-in. sizes, the gate valves in 1½ to 4-in. sizes, and the Y-type in ½ to 1½-in. sizes. Gate valves larger than 2 in. have tapered roller bearings fitted into the yoke bushing so they will operate easily. Source: **Alloy Steel Products Co.,** 1400 W. Elizabeth Ave., Linden, N. J.

●

Valve with integral control system

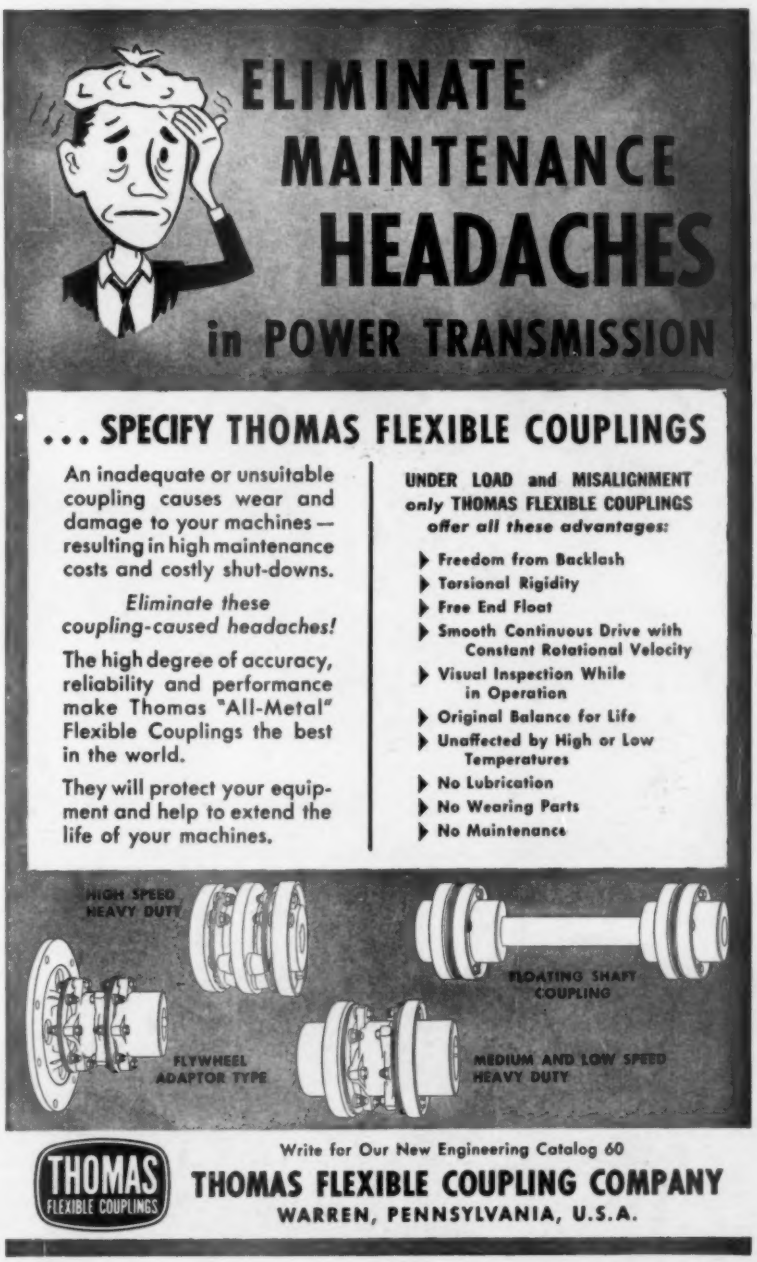
An integral electronic control system is incorporated in this electrohydraulic valve. Compared with older equipment, the new system is said to provide process-control instrumentation capable of higher accuracy and greater response.

System components include the valve, available in all ASA sizes and ratings; an electrohydraulic actuator; electronic controller which provides signals to operate the valve and the necessary system equalization; and associated transducers. Source: **Security Valve Co.,** 909 El Centro, S. Pasadena, Calif.

System automates remote monitoring

A new system for monitoring "interruptibles" and recording gas flow from multiple remote stations is now available. According to the maker, the gas-flow system—known as SD103—features simplicity, ease of installation, long life, and minimum maintenance. Any flow measurement that can be indicated by contact closure (such as base volume index/positive-displacement meters) may be used as an input. Gas-flow count is transmitted over commercial telephone lines and centrally displayed on individual 5 or 6-digit counters. Recording of the counter totals may be on demand or automatic under program control.

The programer scans the counters and presents the count, with time, to a recording device such as an IBM 523 card punch, paper tape punch, or electric typewriter. From 5 to 120 points may be accommodated with ease. Source: **Datex Corp.,** Box 667, Monrovia, Calif.


ELIMINATE
MAINTENANCE
HEADACHES
in POWER TRANSMISSION
... SPECIFY THOMAS FLEXIBLE COUPLINGS
An inadequate or unsuitable coupling causes wear and damage to your machines — resulting in high maintenance costs and costly shut-downs.
Eliminate these coupling-caused headaches!
The high degree of accuracy, reliability and performance make Thomas "All-Metal" Flexible Couplings the best in the world.
They will protect your equipment and help to extend the life of your machines.
UNDER LOAD and MISALIGNMENT only THOMAS FLEXIBLE COUPLINGS offer all these advantages:
Freedom from Backlash
Torsional Rigidity
Free End Float
Smooth Continuous Drive with Constant Rotational Velocity
Visual Inspection While in Operation
Original Balance for Life
Unaffected by High or Low Temperatures
No Lubrication
No Wearing Parts
No Maintenance
HIGH SPEED HEAVY DUTY
FLOATING SHAFT COUPLING
FLYWHEEL ADAPTOR TYPE
MEDIUM AND LOW SPEED HEAVY DUTY
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WARREN, PENNSYLVANIA, U.S.A.

C1534 FLEETSIDE PICKUP ▲

C1504 STEPSIDE PICKUP ▲

R1254 RAMPSIDE PICKUP ▼

K1534 4-WHEEL-DRIVE FLEETSIDE PICKUP ▲

C1416 CARRYALL ▼

FROM CHEVROLET'S NEW WORLD OF WORTH!

JOB-MATCHED CHEVROLET TRUCKS FOR '62

NEW POWER! NEW EYE APPEAL! CHEVIES FOR EVERY CHORE

From Chevrolet's broader-than-ever 1962 lineup of trucks for every kind of hauling job comes a full roster of better-than-ever light-duty models, specialists at trimming tough jobs down to size in short order. Here are new models and new power choices to meet a wider range of working needs, plus a trim new look for all conventional models that gives you safer seeing down the road! Now it's easier than ever to get Chevrolet's traditional thrift and dependability going for you, in the model tailor-made for your kind of job. There are work-loving pickups in a full range of sizes and weight ratings, in sleek Fleetside and handy Stepside styles, plus sensational Corvair 95 Rampside and Loadside models built to outwork anything in their class. In addition, there's the biggest choice ever of *choice* delivery models, including smart, fleet-stepping panels, high-capacity Step-Vans for every job up to 10,000 lbs. GVW, and the wonder-working Corvair 95 Corvan. For specialized requirements there are sturdy stake models and chassis-cabs in every size and weight class, rounding out a selection sure to include a better way to do *your* job! Why not see your nearby Chevrolet dealer for full details on the model made for you, and start finding out right away how much better business can be. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

NEW EASY-VIEW STYLING—For 1962, all conventional pickups, panels and Suburban Carryall models ride in with trim new look-ahead lines, featuring a new hood design sloping lower at the front to let you see the ground as much as 8½ feet closer. Safer, easier viewing results! Also, there's a handsome new grille, new custom exterior trim, and sparkling new colors. Inside, too, things are looking better for the man at the wheel, with new easy-to-live-with colors and tough good-looking upholstery.

NEW STEP-VAN 7—Here's good news—211 cubic feet of it!—for light-duty delivery operators with high-bulk lading problems. And Chevrolet's new Step-Van 7 is built to give your bulky loads a better ride, too, on the years-ahead Independent Front Suspension chassis design that's revolutionized the conventional truck field. With the big-saving High Torque 235 Six under the engine box, there's plenty of power to take your tightest schedules in stride, and a long list of better built body features adds up to easy work and extra-long working life.

NEW HIGH TORQUE POWER—New wider power choice for '62 lets you match your job needs better than ever, in all conventional pickup, panel and Carryall models. There's the standard-equipment 235 Six, cornerstone of the Chevrolet reputation for unbeatable operating economy, and the spirited, ultra-efficient 283 V8 for premium payload punch. *And now, in addition, the heavy-duty 261 Six is available at nominal extra cost, offering an extra measure of stamina and durability to keep on delivering in the roughest, toughest kind of duty.*

JOB-TESTED CORVAIR 95's—They've got a year of enthusiastic acceptance behind them and they're still the talk of light-duty trucking! Chevrolet's sensational Corvair 95 models, in two pickup styles and the spacious Corvan, have set new standards for space and weight utilization in the half-ton field. With a roomy driver compartment up forward and the compact, perky 145 Six tucked under the load floor at the rear, the space between goes to work in a way conventional designs can't match. And, to top it off, this new way to work comes in as pretty a package as ever came down the pike!

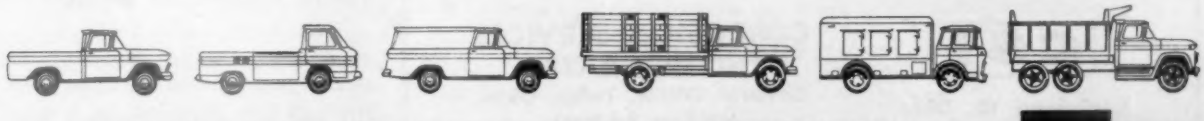
YOURS FOR THE ASKING . . . FREE INFORMATION

Use this convenient ordering coupon to get descriptive literature and specifications on new 1962 Chevrolet trucks to match your job. Just check what you would like, fill in your business address and mail to: Chevrolet Motor Division, P.O. Box 7271, Detroit 2, Michigan.

Please send:
1. Full-Line Brochure..... ☐
2. Corvair 95 Models..... ☐
3. Pickups & Light-Duty.. ☐
5. Suburban Carryalls.... ☐
6. 4-Wheel-Drive Models.. ☐
7. Medium- & Heavy-Duty Models..... ☐
8. Diesel-Powered Models. ☐
9. Tandem Axle Models... ☐

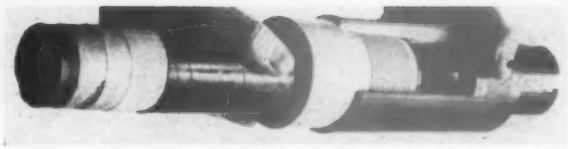
5C

Name
Title
Company
Address
City Zone
County State



1962 CHEVROLET JOBMASTER TRUCKS

CHEVROLET



2-in. plastic pipe for 500 psi.

IN SUCH corrosive applications as crude-gathering lines, salt-water disposal lines, and water-flooding operations, a new plastic pipe may offer advantages. Presently it is available in a 2-in. size for 500-psi. service at 80° F. Three and 4-in. sizes are to be available by June 1962.

The pipe is expected to prove useful as downhole tubing in salt-water-disposal wells and combination injection and disposal wells. The pipe consists of a glass-fiber-reinforced core cocured with and protected by a specially formulated liner and cover. The glass fibers are linked chemically with a plastic matrix based on the Enjay Chemical Co. product, Buton A-500 resin. Maximum operating temperature of the pipe is 250° F. Source: **Spiral-Glas Pipe Co.,** Old Bridge, N. J.

●

Bottom-hole-pressure gage

A permanent record of reservoir pressure can be obtained on chart paper with this new bottom-hole-pressure gage which is permanently installed below the pump on oil wells. The Pressure Sentry Model MK 7 gage can be used to measure the pressure of flowing and shut-in wells as well as that of pumping wells.

Suitable for use in 4½-in. and larger casing, the gage will operate in wells with temperatures to 275° F. and is available in pressure ranges to 8,000 psi. A bourdon-tube coded-disk assembly sends digital signals up a single conductor wire to a surface recording unit.

The maker claims nontechnical personnel can install and operate the gage and that pressure readings can be taken any time. Just attach the recorder to the wellhead connection and turn on the recorder. Thus one recorder can serve several bottom-hole units. Source: **Ball Brothers Research Corp.,** Industrial Park, Boulder, Colo.

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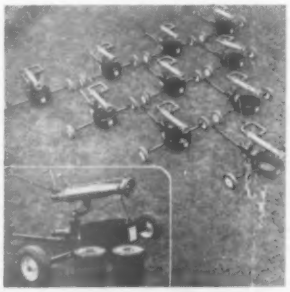

Foam nozzle on wheels

These form nozzles for foam type of fire righting in refineries and other plants consist of a variable-spray nozzle mounted on a two-wheeled running gear equipped with a drawbar by which it can be hitched to a foam truck.

60 OIL WELLS PROTECTED FROM CASING CORROSION

A major company operates 60 oil wells in a field in Coke County, West Texas. When external casing corrosion became a problem, it was decided to protect 35 of the wells cathodically. CSI was given engineering and turn-key installation contracts on a competitive bid basis.

CSI determined the current required for protection on each well, using the "log current potential method" developed and *patented* by a CSI engineer. Current requirements were verified by a down-the-hole potential drop profile. Then CSI installed rectifiers to supply the current.

Recently CSI was recalled—again on a competitive basis—to protect the other 25 wells. CSI again installed rectifiers. CSI also submitted a report covering all installation data, and instructed company personnel on the operating of the rectifiers.

You can benefit from the expert engineering and installation services offered by CSI engineers—who helped pioneer cathodic protection for pipe lines, well casing, tank bottoms, etc. CSI also offers quality supplies for both rectifier and magnesium anode installations. Call or write today.

CSI

CORROSION SERVICES INCORPORATED

Cleveland 13, Ohio
1309 Washington Ave.
Tel. CHerry 1-7795

General Office, Tulsa, Okla.
Mailing Address:
Box 787, Sand Springs, Okla.
Tel. Circle 5-1351

Features include hand grips to aid in maneuvering the units. They are light enough to be moved by one man, if necessary. Mounted directly under the barrel of the nozzle is a cylindrical container for storage of hose.

When fire breaks out, the unit is moved to an advantageous point and the hose connected to a nearby foam truck or other source where foam liquid can be proportioned with water under pressure. The units are capable of throwing a foam or water stream up to 225 ft. away and of delivering a stream of foam at rates up to 4,000 g.p.m. Source: **National Foam System, Inc.,** Adams and Union Avenues, West Chester, Pa.

●

New 25-ton drilling-rig swivel

This new T-12 swivel is available for use in exploratory, slim-hole, and shallow drilling operations and workover jobs. It has an API rating of 25 ton at 100 r.p.m. and a comparative dead-load rating of 50 tons. Suited for use with small portable or trailer-mounted rigs, the swivel measures 46 in. high and 18¾ in. wide, weighs 525 lb., and is recommended by the manufacturer for drilling depths from 1,000 to 2,000 ft. Source: **Armco Steel Corp., National Supply Div.,** 2 Gateway Center, Pittsburgh 22, Pa.

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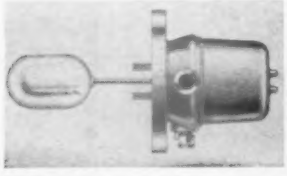


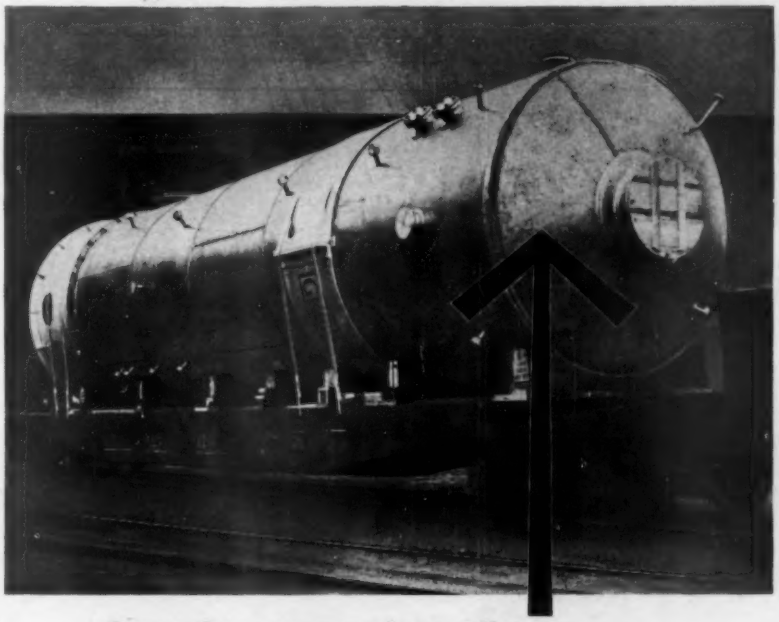
Oil-production level control

Oil production can be controlled with this new float-actuated level controller which consists of three controllers: an electrical snap-acting type, a pneumatic snap-acting type, and a pneumatic throttling controller. All three are designed to mount on a float trunnion assembly.

Vessel-nozzle connections range

from ALCOA

good designs made better with aluminum



Corrosive process in southern chemical plant requires 50-ft aluminum tray tower built by Graver

Look for ALCOA® Aluminum when there's a highly corrosive process to be controlled. Example: this aluminum absorber column is used in the conversion of natural gas to hydrogen cyanide. Built by Graver Tank & Mfg. Co., a division of Union Tank Car Co., the column has an outer diameter of 10½ ft and height of 50 ft. Here again, function, low cost and ease of maintenance indicate a design with aluminum. In so many chemical and process operations, there's no practical substitute for aluminum. For more information, please send the coupon.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

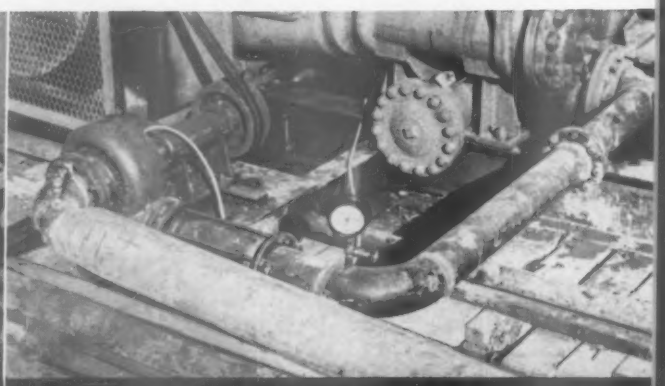
Aluminum Company of America, 826-K Alcoa Building, Pittsburgh 19, Pa.
Please send me the following literature covering Alcoa Aluminum for tubular products and other uses in the process industries.

- ☐ 34-10197 Aluminum Pipe and Fittings
- ☐ 34-10418 Alcoa Unitrace: Combines Piping and Tracing in One Unit
- ☐ 68-10460 Process Industries Applications of Alcoa Aluminum
- ☐ 42-20849 Resistance of Aluminum Alloys to Weathering and Resistance of Aluminum Alloys to Chemically Contaminated Atmospheres
- ☐ 88-11453 Solving Refinery Corrosion Problems with Aluminum

Name_____ Title_____
Company_____
Address_____
City_____ Zone_____ State_____

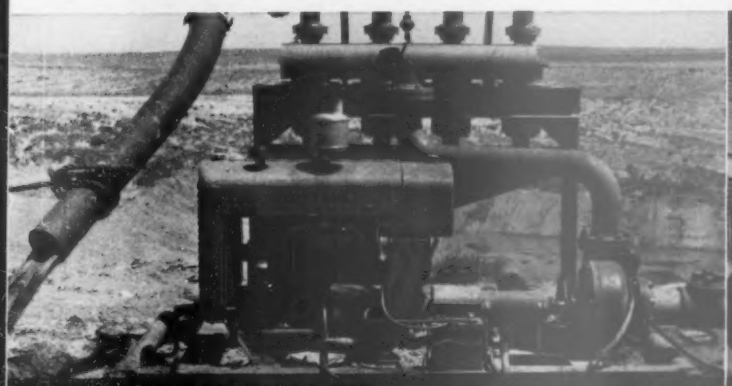
Mission centrifugal pumps for oilwell drilling rig service

MUD PROCESSING — Large volume capacity permits fast, uniform rolling for mixing and treating. Permits rapid addition of lost circulation material when using the special Mission Mud Mixing Hopper.

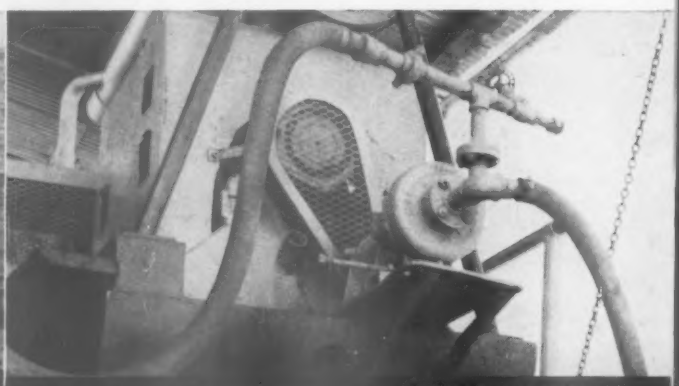


MUD PUMP SUPER-CHARGING — Keeps mud pump at peak efficiency. Prevents mud pump from knocking. Increases mud pump volume when mud is air or gas cut.

originally designed for the most rugged rig applications afford

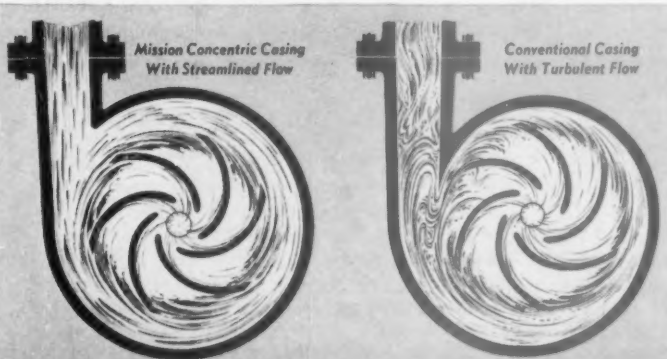


DEGASING AND DESANDING — Mud volume and mud pressure effectively operates degaser and desander equipment.

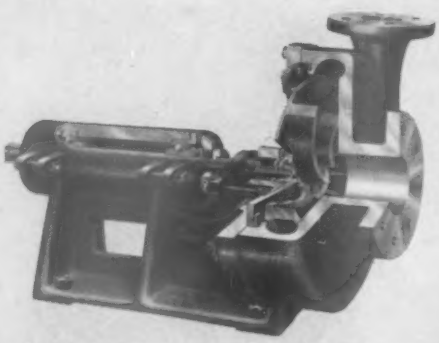


RIG WASH-DOWN AND BRAKE COOLING SERVICE — Provides large volumes and adequate water pressure for economical safe operations.

longer service, easier maintenance, trouble free operation–



MISSION CENTRIFUGAL PUMPS LAST LONGER, WORK BETTER — Streamlined flow is obtained in the concentric casing, because the restriction at the discharge as found in the conventional casing has been eliminated. This design minimizes wear and maintains rated output longer under difficult abrasive and corrosive conditions.



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from 2 and 3 in. screwed to 4 in. grooved or flanged. Maximum pressure rating of the trunnion assembly is 1,440 psi. The temperature rating is 150° F. Source: **Fisher Governor Co.**, P. O. Box 307, Marshalltown, Iowa.

•

Check valve permits full flow

No obstruction of the flow passage is caused by this new Checkaroo check valve as the clapper-hinge pin pivots the clapper out of the stream. Featuring a synthetic rubber seal, the valve requires no lubrication and operates vertically or horizontally.

Equipped with either a pressure gage or test vent, the valve comes in sizes from 2 to 6 in. with threaded, flanged, or grooved connections, in semisteel. Source: **Frank Wheatley Pump & Valve Mfr.,** 520 S. 33rd W. Ave., Tulsa, Okla.

•

Sonic system destroys foam

Foam resulting from various processes can be destroyed with a new continuous-flow defoaming system using sonic energy. Considered suitable for all liquid-processing systems, the sonic defoamer uses a resonant chamber in which any quantity of foam entering the chamber is destroyed continuously by sonic energy.

The defoaming systems come in several diameters, lengths, and foam-handling capacities. The systems are available with flanges for installation in all types of pipe lines. They are operated by compressed air, steam, or other gases. Source: **Teknika, Inc.,** 634 Asylum Ave., Hartford 5, Conn.

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Aluminum eliminates contamination, withstands low temperatures without embrittlement in southwestern polypropylene plant

To prevent product discoloration, this polypropylene process employs ALCOA® Aluminum—in piping, bins, hoppers and vessels. Also, aluminum's excellent low-temperature durability is an important asset; tensile and yield strengths actually increase without embrittlement as operating temperatures drop.

Aluminum is nontoxic, has a higher strength-weight ratio than most metals, costs less to install than any other suitable material. We'd like to send you more information. Please send the coupon.

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- ☐ 34-10197 *Aluminum Pipe and Fittings*
- ☐ 34-10418 *Alcoa Unitrace: Combines Piping and Tracing in One Unit*
- ☐ 88-11251 *Cryogenic Applications of Alcoa Aluminum*
- ☐ 68-10460 *Process Industries Applications of Alcoa Aluminum*

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NEW LITERATURE

Industrial valves

Presented in this publication are specifications and characteristics of the maker's complete line of Flo-Ball valves. Included are cutaway drawings, phantom and exploded views, materials of construction charts, pressure-temperature curves, and dimension tables and drawings. The catalog features several series of top-entry 150-lb. ASA flanged valves, 300-lb. ASA flanged valves, 600-lb. w.o.g. screwed-end bar stock valves, and vacuum to 3,000-psi. shutoff valves. Source: **Hydromatics, Inc.,** 5 Lawrence St., Bloomfield, N. J.

Meters and accessories

Catalog P&I-2000 offers descriptions, illustrations, specifications, and dimensions of the following types of meters: oil-field production, industrial, petroleum tank truck, oil marketing, and pipeline; along with packaged units for volatile liquids. Accessories described in the 28-page catalog include electrical-impulse contactors, a key control panel, air eliminators, line strainers, registers, and temperature compensators. Source: **Petroleum & Industrial Div., Rockwell Mfg. Co.,** 400 N. Lexington Ave., Pittsburgh 8, Pa.

Inert bits

Designed to cut shot-hole costs, the bits come in sizes from 4 to 4¾ in. A new six-page folder describes three types of bits: Type A for soft to medium formations; Type C for medium to hard formations; and Type 4A for extremely hard and abrasive formations. Source: **Gault Tool Co.,** Box 186, Allen, Okla.

Differential-pressure instruments

Twenty-eight-page Bulletin G-61 is packed with illustrations and descriptions of various recorders, transmitters, integrators, controllers, and indicators for a wide range of applications. Included is information on accessories, liquid-level instruments, and a corporate history. Source: **Industrial Instrument Corp.,** 8400 Research Rd., Austin, Tex.

Polyethylene pipeline coating

X-Tru-Coat, a new high-density pipeline coating which is bonded to steel pipe by a "live" adhesive, is the topic of obtainable Bulletin 201. The four-page literature piece details the coating's physical and electrical properties and includes a corrosion-resistance table, along with sketches of typical applications. Source: **Hill Hubbell Co.,** 3091 Mayfield Rd., Cleveland 18, Ohio.

Gas regulators

Two new bulletins, containing data on gas regulators, are now being offered free to interested persons. They are: Bulletin RV-161, on relief valves, eight pages; and Bulletin AP-161, on pilot, small-volume, appliance and industrial-equipment gas regulators, eight pages. Source **Reynolds Gas Regulator Co.,** 1416 Lincoln, Anderson, Ind.

New heat-transfer surface

Twenty-eight-page Bulletin 356 describes and illustrates Panelcoil,

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With Safomatic Valves you can design an economical, positive safety system for every type application where high and low pressure limits are important. Write today for Brochure #SFO.

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a heat-transfer surface for numerous industrial uses. Containing a wealth of information on heating, cooling, and heat transfer, the technical publication features an instantaneous logarithmic mean-temperature-difference chart. Included are data on how to figure heating load, how to select heating surface, along with pressure-drop short cuts. Source: **Dean Products, Inc.,** 1042 Dean St., Brooklyn 38, N. Y.

Switches for efficient operation

Micro Tips, Vol. 1, No. 30, contains ideas submitted by plant engineers and electricians showing how they've used snap-atcion switches to increase production efficiency. Illustrated by drawings and photographs, the four-page issue contains five methods said to save man-hours, protect operators and machinery, and eliminate waste. One section tells how precision switches are used to curb stock spoilage by monitoring the production of delicate instrument reeds. Source: **Micro Switch Div., Minneapolis - Honeywell Regulator Co.**, Freeport, Ill.

Closed-circuit television

This new brochure (10 pages) tells how closed-circuit television can be used for surveillance, transportation and dispatching, cost reduction and quality control, merchandising, security, and observation of hazardous locations. Also described is the Mini-Camera, able to observe the interior of 3-in. pipe. Source: **Electronics Div., Fairbanks, Morse & Co.,** 100 Electra Lane, Yonkers, N. Y.

Packaged field compressors

Model AM-2 and AM-4 packaged field compressors, as introduced in Bulletin 101, are available in more than 25 models, from 100 to 1,100 b.hp. and with discharge pressures up to 6 000 psi. The four-page bulletin describes special features of the compressors, which are balanced during construction for trouble-free operation in gas lift, gathering, boosting, and injection. Also included are dimensions and operating data. Source: **Cooper-Bessemer Corp.,** Box 751, Mount Vernon, Ohio.

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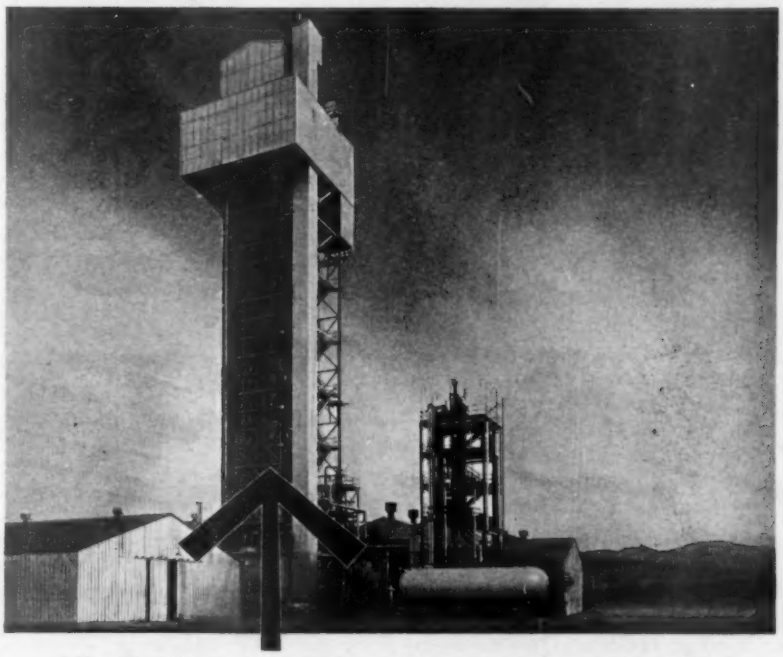

All-aluminum construction resists corrosion, weatherproofs thermal insulation in Spencer Chemical prilling tower

This 180-ft, all-aluminum, urea prilling tower, operated by Spencer Chemical Co., Henderson, Ky., was built by Mississippi Valley Structural Steel Co., St. Louis, Mo. To ensure uninterrupted, corrosion-free service, plant designers used Alcoa® Aluminum throughout—frame, walls, bolts, piping, fittings, connections and fasteners. Aluminum sheathing weatherproofs thermal insulation on tower, heat exchangers and piping. Please send the coupon for more information about Alcoa Aluminum's unique advantages.

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- ☐ 03-19122 *Alcoa Structural Handbook*
- ☐ 42-20849 *Resistance of Aluminum Alloys to Weathering and Resistance of Aluminum Alloys to Chemically Contaminated Atmospheres*

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EQUIPMENT MEN

Edward R. Huckman assumes sales post with Foxboro Co., Ltd.

As general sales manager, he will have charge of all industrial instrument sales activities for the Montreal firm and its branch offices in St. John, Toronto, Sudbury, Port Arthur, Edmonton, Calgary, and Vancouver. A veteran in the field of process measurement and automatic control, Huckman started his instrument career in 1927 at the company's main plant in Foxboro, Mass.

After sales assignments in Tulsa and Dallas, he was made manager of the St. Louis office. In 1941 Huckman moved to the New York office as assistant branch manager, was appointed manager in 1948, and regional manager in 1955. For the past 3 years he has been assistant field sales manager for the U. S. sales organization.

Welex makes two changes

George Harcourt, former Dallas area sales manager, has been named to direct the company's new customer program. He will headquarter in Welex's Houston division sales office. Assuming the additional duties of Dallas area sales manager is Weldon Porter, chief completion services engineer, who will continue to headquarter in the Dallas sales office. Harcourt has 13 years experience in oil-well servicing. Porter, who joined Welex in 1954, has been active in the oil industry since 1940.

Sauder Tank Co., Inc. makes sales, engineering assignments

Harold Hicks has been named branch manager of Sauder Tank's recently opened Oklahoma City sales office. Formerly division manager for a Tulsa firm in West Texas, Hicks has been in oil and gas production-equipment sales and service the past 9 years.

Jon M. Sjogren has joined the engineering staff at the company's home office in Emporia, Kans. He will handle design and development of automation equipment.

Brown, Baker Oil Tools sign license agreement

C. C. Brown, president of Brown Oil Tools, Inc., announces the signing of a patent licensing contract with Baker Oil Tools, Inc. Under terms of the agreement, Baker acquires nonexclusive license to use and sell such multiple-completion methods and equipment under patents issued to Brown.

SUBSIDIARY REACQUIRED during this formal signing by George M. Cheathem (left), president of Maloney-Crawford Tank & Service Co., Ltd., Edmonton, Alta.; and R. C. Schenk, president of Maloney-Crawford Tank & Mfg. Co., Tulsa. The agreement makes the Canadian firm a subsidiary of the U. S. company once again. Maloney-Crawford formed the Canadian division in 1948 and it became a separate company 4 years later when it was purchased by its officers. Manufacturing will continue at the Edmonton plant. Five branch offices are located throughout western Canada. No personnel changes will take place. D. L. Beattie will remain as manager of manufacturing; M. A. Jackson as chief engineer; F. B. Matthews as sales manager; and John Montgomery as treasurer.

Darrel D. Byerley becomes Detectron general sales mgr.

Field sales manager of Tinker & Rasor, San Gabriel, Calif., Byerley takes on these new duties at the company's newly acquired Detectron Division. He will be in charge of sales for Detectron instruments in addition to his sales duties for Tinker & Rasor holiday detectors. The full line of Detectron pipe, metal, and leak locators and thermomagnetic-type valve testers is now being manufactured at Tinker & Rasor's San Gabriel plant.

Grove Valve & Regulator Co. appoints two sales engineers

The announcement comes from George E. Doty, vice president and general sales manager of the Walworth subsidiary. George H. Loeffler will specialize in the sale and engineering application of valves for the refinery and chemical industry. He has had more than 15 years sales and technical-service experience in this field in the Gulf Coast and Mid-Continent areas.

M. L. Wheat, associated with the sales and manufacture of oil-field and pipeline equipment for 13 years, is an "inside office" technical sales specialist. Both men will be headquartered in Grove's Houston sales office.

Robbins & Myers creates unit to be known as Airtrol Division

With headquarters in Springfield, Ohio, Airtrol will specialize in the design, production, and marketing of unit-type collectors for the control of dusts and mists. E. J. Stone has been assigned managership duties for the new division.

Richard F. Musson joins Packard Bell Computer Corp.

He takes over as sales manager for computer products. The corporation is a division of Packard Bell Electronics. Musson will direct sales of the PB 250 general-purpose digital computer, the complete line of accessory and peripheral equipment for the PB 250, and the TRICE digital differential analyzer line. He will headquarter in Los Angeles.

EXAMINING WORK being done on a turret lathe being rebuilt in Hughes Tool Co.'s new machine-tool-rebuilding plant in Houston is A. H. Wooler, vice president of manufacturing (left), and M. E. Montrose, senior vice president and general manager. Containing 90,000 sq. ft., the machine-tool-rebuilding unit was just recently completed. The plant is designed to serve manufacturers in a 20-state area in the South and Southwest.

Joy Mfg. Co. elects vice prexy, general manager for division

John W. Thornton assumes the title of vice president and general manager of the Industrial Division of Joy Mfg. Co. He formerly was vice president of marketing. Thornton joined Joy in 1957. He previously was employed by McKinsey & Co., Inc., in New York, and by Brown Brothers Harriman & Co., in Boston.

Cummins Engine Co., Inc. names Marion C. Dietrich to sales post

As director of sales (parts and special products) and a member of the company's executive committee, Dietrich will be responsible for Cummins part sales and distribution, along with special product sales of domestic subsidiaries. Since 1955 Dietrich has been director of marketing and general sales manager of Kiekhaefer Corp. Before that he was with Ford Motor Co. for 9 years.

Engine production is started at new Allis-Chalmers plant

Production of Allis-Chalmers engines has begun in a new 515,000

from ALCOA

good designs made better with aluminum

Alumi-Louvers provide dependable, economical ventilation at New York State Natural Gas Co.

For uninterrupted, maintenance-free performance, Mansfield Metal Fabricating Co., Mansfield, Ohio, constructs its famous *Alumi-Louvers* of Alcoa® Aluminum. A typical installation (shown) is at New York State Natural Gas Co., Tamarack, Pa. *Alumi-Louvers* require no maintenance, provide dependable, economical control of ventilation and temperature. Mansfield reports that lightweight aluminum cuts transportation and installation costs (special rigging is unnecessary). For more information about corrosion-resistant aluminum, please send the coupon.

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WILLIAMSPORT 1, PA.

sq. ft. engine-manufacturing facility recently completed at the company's Harvey, Ill. works. Erected on 35 acres, the new 440 by 1,100 sq. ft. steel and concrete structure contains modern production equipment.

The plant has four semiautomatic assembly lines which are capable of producing more than 130 different variations of 4 and 6-cylinder diesel, gasoline, butane, and gas engines. A fifth line is manually controlled and from it flow engine-driven electric sets, power units, marine engines, and special industrial engines.

Frank B. Haughton joins staff of Republic National Bank of Dallas

Formerly a land man for Sun Oil Co., Haughton will now serve as land man in the oil division of Republic's trust department. He will give specialized attention to estates and trusts under the bank's care which include oil and gas interests among their assets.

Motorola executives elected corporation vice presidents

H. L. Marrs

W. J. Weisz

Homer L. Marrs, national sales director of Motorola's Communications Division, becomes vice president of sales for the division; William J. Weisz, manager of mobile and portable communications products in the Communications Division, becomes vice president of communications products for the division.

Marrs' 23-year career with Motorola, in which he has pioneered the distribution of mobile communication systems, dates from 1938 when he joined the Communications Division. Weisz joined the company in 1948.

Tulsa, Houston offices opened by division of Republic Steel

The corporation's Steel & Tubes Division has named W. L. Garay as Houston district sales manager. He was transferred from Steel & Tubes' New York sales district office. The new district covers Texas, New Mexico, and western counties in Louisiana. R. E. Hornak was transferred from the Kansas City office to Tulsa. His district will include Oklahoma, seven counties in southeastern Kansas, 15 counties in southwestern Missouri and, for electrical tubular products only, most of Arkansas.

At the same time it was announced that Frank E. Gault has been appointed assistant manager of sales for Republic Steel's Pipe Division. Gault has been vice president in charge of sales for Republic Supply Co., Oklahoma City subsidiary.

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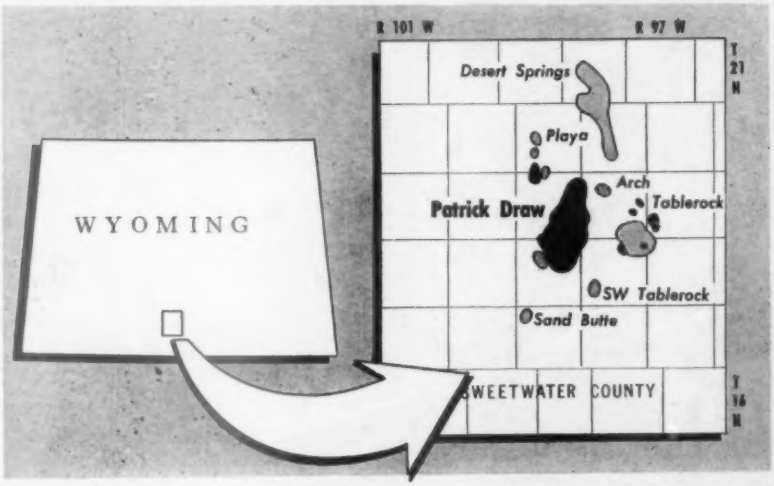

DATA ON ACTIVE FIELDS

Patrick Draw field, Sweetwater County, Wyoming

1. Approved field name: Patrick Draw. Location: Sweetwater County, Wyoming, on the Wamsutter arch of Green River basin.

2. Discovery well: El Paso Natural Gas Co. 1 Patrick Draw unit, 1-18n-99w, Sweetwater County, Wyoming, discovered October 12, 1959, IP 637 bbl. per day of 42° oil from Almond sand at 5,198 ft., total depth 5,656 ft.

3. Trend of development: South to north.

4. Number of producing wells: 132.

5. Spacing pattern: 80 acres.

6. Proved acreage: 12,500, approximately.

7. Principal operators in area: El Paso Natural Gas Products Co., Gulf Oil Corp., Union Pacific Railroad Co., Texaco Inc., Colorado Oil & Gas Corp., Texas Natural Petroleum Co., and Forest Oil Corp.

8. Present allowable: Average of 150 bbl. per day per well.

Drilling Operations

9. Number of active drilling rigs: Five.

10. Casing program: 8⅝-in. casing set at 285 ft. with 155 sacks of cement. 5½-in. oil string set at 5,403 ft. with 260 sacks of cement.

11. Average drilling time per well: 15-17 days.

12. Types of drilling fluid: Bentonites, 500 lb.; preservatives, 100 lb.

13. Completion methods: Perforate casing and fracture treatment.

14. Types and sizes of bits: 8¾-in. and 7⅞-in. rock bits. Total of 7 bits.

15. Special drilling problems: None.

Geology

16. Producing formations: Upper Cretaceous-Almond sand at 4,900 to 5,300 ft.

17. Reservoir characteristics: Type drive: Solution gas, gas cap expansion, and water. Gas-oil ratio: Initial 525:1. Oil-water contact: +1,415 ft. and +1,625 ft. Gas-oil contact: +2,480 ft.

18. Geologic markers: Lewis at 3,500 ft.; Almond at 4,900 ft.; and Erickson at 5,200 ft.

19. Type trap: On the west flank is Rock Springs uplift but locally the dip is regional. This is a classic example of a stratigraphic trap with lenticular sands.

20. Core data: Porosity, 19.5%. permeability, 35 md.; residual oil saturation, 18%; total water saturation, 45-50%; cored interval, 4,900-30 ft.; net feet of pay, 20 ft. average.

21. Estimated recovery: 250 bbl. per acre-ft.

22. Pressures: Tubing, 200-600 psi. Casing, 400-1,200 psi.

23. Tests and logging procedures: Core, drill-stem test, induction-electric log, and micro-caliper log.

24. Pipeline outlets: Colorado Interstate and Service Pipeline Co.

25. Exploration methods prior to discovery: Seismic and subsurface geology.

26. Average costs: Dry hole $25,000. Flowing well $55,000. Pumping well $65,000. Average total depth 5,300 ft. Footage rate $3.00. Day rate with pipe $750.

27. Crude analysis: gravity, 42.3° to 45.4° API; per cent sulfur by weight, 0.04; viscosity at 70° F. S.s.U., 35.0; viscosity at 100° F. S.s.U., 33.5; pour point, 63; basic sediments and water, none.

Watch Wyoming's Raven Creek field

AN ACTIVE Rocky Mountain area is Raven Creek in Campbell County, Wyoming. It is now the largest Pennsylvanian producing field in the eastern Powder River basin, both in total number of wells and daily production.

Since May, drilling has spread from sections 23 and 24, 48n-69w, more than 3 miles northwest into sections 34 and 35, 49n-69w. At least a half dozen rigs are working in the sector.

The field started with a rather feeble beginning when four dry holes, two northeast and two southwest of production, appeared to limit the field in two directions. But there has been no slackening of pace. It appears that the continuing trend of production will be southeast to northwest.

The general area is good. Nearby to the northeast are several good fields including: Slattery, Coyote Creek, Donkey Creek, and South Donkey Creek. And it's less than 12 miles away to Rozet which lies northwest.

The well which led to the initial discovery at Raven Creek was completed in the Dakota in 1955, which was abandoned before Kewanee drilled a Minnelusa test early in 1960. This well made 440 bbl. daily on pump at perforations from 8,338-65 ft. The first successful offset well drilled by Kewanee flowed 225 bbl. daily. With the exception of the first four wells, all others have been completed in 1961.

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TECTONIC SETTING of the Texas Panhandle and western Oklahoma points to an ultimate payoff in the big Palo Duro basin. Four important discoveries in the eastern lobe, and brisk leasing in Oklahoma's small portion of it, will lead to others in the months ahead.

Texas success could jump a river into Oklahoma

BY FRANK J. GARDNER

WHEN IT COMES to exploration for oil, there's never a dull moment in Oklahoma. As the years have passed, wildcatters have shifted the scenes of drilling interest from east to west, north to south, and back again.

Today, that interest centers in a new corner—the extreme southwest. In a two-state play that began in northern Texas, Oklahomans are inking leases in Harmon and Jackson counties at a rapid pace. And leases that went for $2.00 an acre a few months ago now carry a $7.50 price tag.

So far, the Oklahoma side of the play has seen no discovery, but happenings across Red River in Texas have provided the stimulus for the leasing campaigns. Actually, two old strikes in Jackson County should have been the tipoff on the Oklahoma possibilities here. One of these, Carmel field, is now abandoned, while the other, Southwest Duke, is still a one-well speck on the map.

Hits in Texas. The setting for the Texas play, and for the one to come in Oklahoma, is a two-lobed basin astride the state line which is an eastern arm of the vast Palo Duro basin of the Texas Panhandle (see map). The Texas downwarp is known as the Hardeman basin, while the one in Oklahoma is often called the Hollis basin or Harmon basin.

The strike that triggered the initial interest in this region was made in Hardeman County, Texas, in 1959, when Shell Oil Co. opened Conley field (OGJ, Apr. 24, 1961, p. 215). Today, Conley stands as one of the best new fields of recent years in North Texas. The discovery was finaled in Mississippian-Meramec at 7,790 ft. Since then, oil has been found in the Pennsylvanian-Palo Pinto, the Mississippian-Osage, and the Ordovician-Ellenburger.

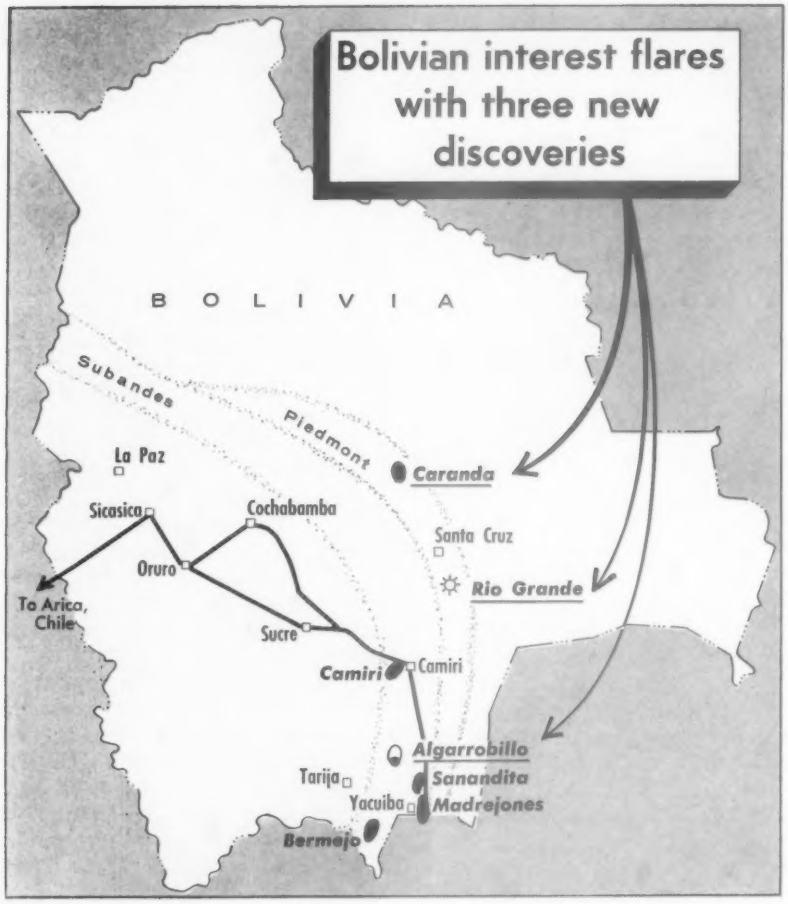
Conley was the first "really big" oil field in Hardeman County. It was the first in the Palo Duro basin. Shell had found Alamosa field, Oldham County, in the western part of the basin in 1957, but it proved to be a pooper.

Following the Conley development, one more field popped up in Hardeman County, one in Foard County, and one in Childress, first for that county. Kewanee Oil Co. 1 Sandifer, on the edge of the Red River uplift, opened East Crowell field (Foard County) in June of this year as a Strawn-Pennsylvanian producer. Hardeman's second field came at Medicine Mounds a month later, when J. C. Maxwell finished his 1 McClellan as a Mississippian producer at 8,200 ft. In Childress County, meanwhile, O. P. Leonard had discovered Cisco-Pennsylvanian reef oil at his 1-A Perkins to open Kirkland field.

Mean hopes for Oklahoma. All this success was bound to spill over into Oklahoma, and it will. The thousands of acres now going to lease in Jackson and Harmon counties assure that.

Meanwhile, in the main body of the Palo Duro basin, one deep failure has hit the books this month, and another bold wildcat has been announced. Texaco Seaboard, Inc., hit the dust at its 1 Hall in Briscoe County at 8,501 ft., while Roy Furr, Lubbock independent, staked location for his 1 Beckman in Section 46, Block B-5, H&GN Survey, Randall County (see map).

All this activity, on both sides of Red River, spells only one thing—a two-state push toward the ultimate success that is Palo Duro's due. It **has** to come.



SOUTH AMERICANS are looking with new hope to Bolivia as one of the continent's most promising future oil provinces. Three recent discoveries have done much to incite a new wave of enthusiasm in the country's oil prospects. Earlier forecasts for reduced activity in 1961 may have to be altered as a result of these new strikes. The Caranda find opens a whole new avenue for exploration along the Piedmont.

Three finds

A TRIO OF DISCOVERIES in Bolivia has reawakened exploratory interest in this long-neglected South American nation.

Bolivia has always been considered a ripe prospect for oil finders, but its land-locked and rough terrain, great distance from world markets, uncertain politics, and sheer disinterest, have combined to block full-scale drilling campaigns for many years. Although South America's first oil was found here in 1875, the country's oil business didn't hit the news until the 1950's.

Three important strikes. Three recent discoveries at Caranda, Algarrobillo, and Rio Grande have brightened the rather dim oil picture in Bolivia.

Bolivian Gulf Oil Co.'s Caranda discovery in 1960 opened oil production in an entirely new province, far north of nearest production at Camiri. The well, northwest of Santa Cruz, flowed 300 bbl. of 50°-gravity oil daily from lower Gondwana Devonian pay. This first oil north of Camiri paved the way for an accelerated search along the Piedmont and Subandean belts running north and northwest from the Argentine border.

Bolivian oil data *

WELL COMPLETIONS—1960

Company—	Wildcats Total	Wildcats Oil	Wildcats Gas	Wildcats Dry	Field wells Total	Field wells Oil	Field wells Gas	Field wells Dry
Y.P.F.B.	2	0	0	2	20	18	0	2
Gulf	13	1	0	12	1	1	0	0
Chaco	3	0	0	3	0	0	0	0
Bolivian Oil	0	0	0	0	2	1	0	1
Total	**18**	**1**	**0**	**17**	**23**	**20**	**0**	**3**

PRODUCTION—1960

Company, field—	Bbl. Total	M.c.f. Total	Daily average (b/d)	Daily average (M.c.f.d.)
Y.P.F.B.				
Camiri	2,496,325	4,036,537	6,820	11,028
Guairuy	119,519	.....	326	.....
Itapirenda	24,971	.....	68	.....
Sanandita	20,056	.....	55	.....
Bermejo	81,220	.....	222	.....
Toro	368,345	.....	1,006	.....
Total Y.P.F.B.	**3,110,436**	**4,036,537**	**8,497**	**11,028**
Bolivian Oil				
Madrejones	461,975	.....	1,920	.....
Total Bolivia	**3,572,411**	**4,036,537**	**10,417**	**11,028**

*Source: AAPG July Bull. 1961.

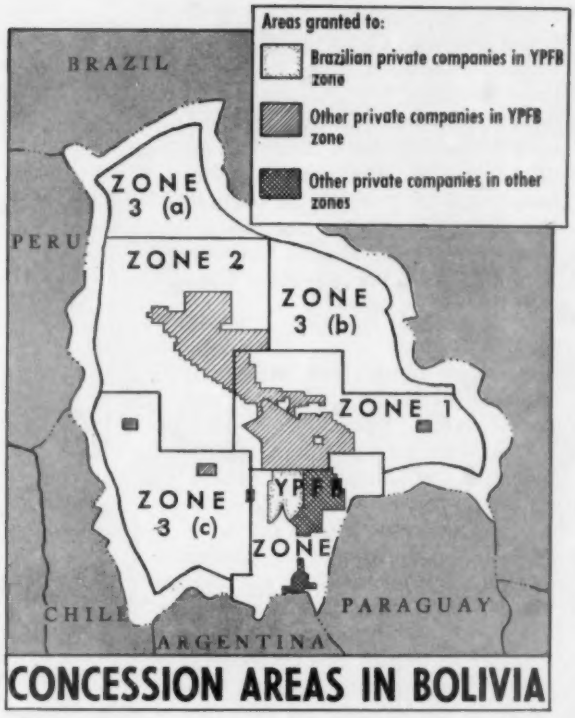
awaken Bolivia

BY JOHN C. McCASLIN
Geological Editor

This summer Gulf brought in its fourth well at Caranda. Recovery was 60 bbl. of 53°-gravity crude on a 90-minute test from perforations at 3,573-93 ft. The No. 3 Caranda well, completed earlier, flowed 1,570 bbl. daily from pay at 3,600 ft. The No. 2 Caranda well, completed last year, flowed 400 bbl. daily. The Caranda structure appears to be about 10 miles long and is considered the most important discovery in many years for Bolivia.

In September this year, Gulf announced discovery of gas-condensate at its 1 Rio Grande wildcat, 35 miles southeast of Santa Cruz. The discovery flowed 9 M.M.c.f.d. through ½-in. opening from 5,200-ft. pay. Some condensate accompanied the gas. Location is in the southern part of the 1,200,000 acres owned by Gulf in the general Santa Cruz region on concession from Bolivia. More drilling on the Rio Grande prospect is needed before complete evaluation can be made. Several deeper formations in the general area are considered prospective pays, including one at Caranda. Gulf plans to test these in future drilling.

A new gas and oil discovery was made last summer at Chaco Petroleum's 1 Algarrobillo wildcat in the southern part of the country, 40 miles north of the border city of Yacuiba. This well flowed 317 bbl. of 56.3°-gravity oil per day and 6,800 M.c.f.d. Partners in this find were Union Texas Natural Gas Co., Lion Oil Co., and Murphy Corp. Chaco is a Tennessee Gas Transmission Co. subsidiary.



CONCESSION AREAS IN BOLIVIA

LAST YEAR, 15 private companies held concessions in Bolivia in addition to the government company, YPFB. There were 7 of these in active operations.

Exploration 1960. Only one of last year's 18 wildcats in Bolivia hit. Gulf found oil at Caranda in Zone 1. A new-pay discovery was made by YPFB at their C-50 well in Camiri field. The government oil agency also added 10 new producers at Camiri, deepened five old wells here, added one new well at Bermejo, and seven at Toro. Bolivian Oil Co. completed two producers at Madrejones, one of which declined.

1961 DATA—FIRST HALF

	Production (bbl.)
January	243,041
February	239,526
March	238,683
April	220,613
May	241,056
June	227,045
Total	**1,409,964**

	Footage drilled (ft.)
January	10,624
February	9,216
March	14,212
April	13,539
May	4,041
June	12,156
Total	**63,788**

There were 15 private companies holding concessions in Bolivia last year besides YPFB. Only seven were actively looking for oil. Operating companies are: Cia. Petr. Boliv. Shell with 1,748,624 hectares under concession, Bolivia California Petroleum Co. with 1,904,637, Bolivian Gulf with 3,195,747, Andes Oil Co. with 475,589, Chaco with 179,829, Bolivian American Oil Co. with 1,122,350, Bolivian Petroleum Corp. with 360,846, Cataract Mining Corp. with 114,750, White Eagle International Oil Co. with 94,940, Bolivian Texas Oil Co., Bolivian Oil Co. with 43,800, Cia. Uniao de Brasil de Petr. 269,341, Petroleo de Bolivia 217,201, Cia. de Petr. Andina 332,931, and Cia. Petrolif. Brasileira with 304,000. The seven active companies were Shell, California, Gulf, Chaco, Bolpecor, Uniao, and Cia. Brasileira. One, Bolivian Oil Co., was developing its own field—the other seven were inactive.

Long-awaited excitement. Bolivia's oil interest really got excited with the completion of 3 Caranda earlier this year. This big well revived hopes for big production in the country.

Bolivian Gulf itself has spent more than $16 million since 1956 in Bolivia, and has been the chief operator. Gulf Oil holds 80% in-

Bolivia's Producing Horizons

		SUBANDES	CENTRAL & EAST
PALEOZOIC	Permian	Arenicas	Arenicas
	Carboniferous	● Candado Madiyuti	Yaco
		Rio Bem	Cuchabanda
		● Tarija ● Tupambi	
	Devonian	● Iquiri ● Las Muras ● Espejos	● Gondwana
	Silurian		Clarkeia
	Ordovician	● Tarene Cosincho	Cochabamba Inamayo etc.
	Cambrian		

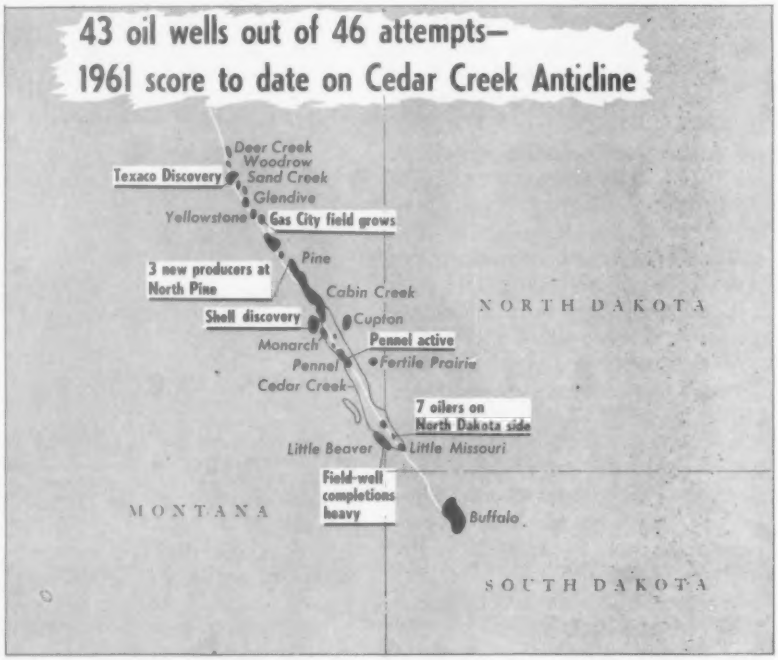
terest in the company, Falcon Seaboard Drilling Co. and Barry & Reiner, Inc., each have 7%, Williams Brothers 6%. Bolivian Gulf had drilled 17 deep wells up to January 1 this year for a total footage of 134,500 ft. The company also had drilled 25 stratigraphic tests. It has 8,650,000 acres under concession, and is developing another 1,110,000 acres under contract from YPFB.

Years of uncertainty may end. Bolivia's oil picture has always been confused. For 15 years before 1956, YPFB had a monopoly on exploration and production in the country. A new oil law in 1956 attracted foreign oil interests, giving rise to a 100 million dollar plus oil-hunting campaign. After the oil law was passed, Bolivia was divided into six areas, one of which was set aside for YPFB, though not exclusively. YPFB could arrange for private contracts for exploring in its own section. Part of its zone and part of Zone 1 on the north were reserved for Bolivian-Brazilian joint exploration. About 12.6 million hectares have now been taken up by private companies.

Only way is up. Domestic demand in Bolivia is very low at about 5,600 bbl. daily. Any hike in crude output must be given to foreign markets. The country hopes for and expects increased production as the years advance. A 350-km. 10½-in. oil pipeline from Sicasica in Bolivia, across the 14,000-ft. Andes to Arica on the Pacific coast of Chile, was completed in 1960, but is not in regular use. Pemex of Mexico expresses desire for 50,000 bbl. per day from Bolivian fields which would go through this outlet. Argentina plans to add to its 1,500-bbl. per day take from Madrejones field on the south. Chile, Paraguay, and Brazil also import some oil from Bolivia. But total exported Bolivian oil now only amounts to about 3,000 bbl. daily.

There are four small refineries in the country; YPFB owns all of them. Cochabamba has a 6,000-bbl. per day capacity, Sucre 4,000 bbl., Camiri 1,500 bbl., and Sanandita 400 bbl.

Bolivia's rise as an oil power in South America will take time. Increases in YPFB's own output will be slow in coming. Exploration now going on in the country by foreign companies will be expensive and time-consuming. But the three recent discoveries have certainly given new hopes to a country whose future depends almost entirely on the success of its oil industry. Oil appears to be the country's only out if it expects to become economically healthy. Tin is no longer king.



THE SOUTHWESTERN CORNER OF WILLISTON BASIN, long too quiet, seems to be stirring again as development and wildcat drilling go up along the long Cedar Creek anticline.

Montana's Cedar Creek one of year's busiest trends

LACK OF PUBLICITY has denied the Cedar Creek anticline of Montana its rightful place among the busiest field-well development areas in the country this year. Actually the long Williston basin-edge structure is enjoying its most brisk drilling period since the mid-50's. A look at the accompanying data sheet shows that this is one corner in the Williston basin that isn't quitting.

Most prolific area. Oil is only 10 years old on the Cedar Creek anticline. After its tenth birthday went by quietly, figures on production were found to be climbing rapidly. Daily average oil output from the many fields along the northwest-

County—	Total field wells drilled	New oil wells	Active tests
Dawson	9	8	3
Fallon	28	27	8
Prairie	8	7	1
Wibaux	1	1	0
Bowman, N.D.	*(7)	7	2
Total Montana Cedar Creek	46	43	14

*Not included in Montana total.

Total Montana state-wide development wells 165 124

Cedar Creek anticline drilling is more than 28% of total state of Montana.

Success ratio of Montana portion of anticline drilling is 93.5%, North Dakota portion, 100%.

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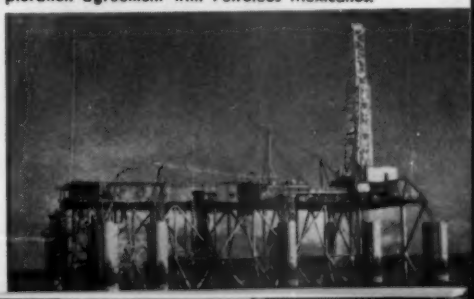
EXPLORING Mexico's first offshore field, "El Dorado" barge is being operated by Perforaciones de Mexico, S.A., drilling contractors, for Pauley Pan American Petroleum Co., under exploration agreement with Petroleos Mexicanos.



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southeast structure is about 36,000 bbl. Northwestern Montana fields only put out about 10,000 bbl. daily, and only 20,000 bbl. daily in Central Montana fields.

Pine field is the biggest producer with 14,600 bbl. daily; cumulative production here is more than 21,500,000 bbl. Cabin Creek field is producing more than 10,000 bbl. per day with more than 20,000,000 bbl. to its cumulative credit. Cumulative total for the entire anticline is more than 66,000,000 bbl. of oil (source Petroleum Information, Denver). The only field in Montana with a higher total output is Cut Bank with its 92,250,000 bbl. That's an enviable record for a 19-year old area and Cut Bank was discovered back in the mid-20's.

Four counties figure in the growing development play on Cedar Creek anticline—a play that even crosses the line into Bowman County, North Dakota. Field-well drilling is particularly heavy in Fallon, Prairie, Dawson, and Wibaux counties. Dawson County work centers in the Gas City unit, 13n-55e. Shell Oil Co. moved production 20 miles northwest, closing a gap of 4 miles that separates various parts of Gas City unit.

Three oil wells on the north end of Pine unit in 12n-56e, Prairie County, are filling in a void that had seen only scattered development. Scattered wells are on the records farther south on Pine unit, also. The north end of Pennel field in 8n-59e, Fallon County, has seen a busy drilling year. Most of the new wells have been around older wells except for one stepout that moved production more than a mile northeast. That well was Shell 42-14 Government in SE NE 14-8n-59e. Pump gage was 170 bbl. of oil and 17 bbl. water daily from Red River Ordovician perforations at 8,794-8,806 ft. This outpost discovery now has a north extension. A south extension was also completed for 208 bbl. of oil and 88 bbl. water per day from Red River. Pennel also moved about 1 mile to the south with two new wells in NW NW and SE NE 12-7n-59e.

The extreme southeastern end of the long anticline has been busy this year with development strong in Little Beaver and Cedar Creek fields. Drilling here consists of short extensions.

Two new fields were opened along the anticline during the first 9 months of 1961. The most recent discovery is Texaco's apparent strike in Dawson County at 1 NP-G(NCT-12), NE SW 17-16n-54e, Woodrow area. This well swabbed 80 bbl. of oil in 3 hours, 50 minutes, or 480 bbl. daily. Pay is the Silurian at 9,137-46 ft. Swab got 157 bbl. of oil in 12½ hours from Red River perforations at 9,718-33 ft. This wildcat is on the north side of the anticline between Sand Creek and Woodrow fields. Sand Creek field is 9 years old, has eight producers, averaging 536 bbl. per day. Cumulative output is about 600,000 bbl. There are dry holes southeast of Texaco's new well. Woodrow field lies 20 miles northwest. It also is 9 years old, had two wells, and a cumulative output of 150,000 bbl. There is no activity between Woodrow and the new Texaco well, opening a favorable link-up area to drilling.

Earlier this year, Shell Oil Co. and Northern Pacific Railway Co. found Mission Canyon Mississippian oil at the M-12-15 NP wildcat in SW NW 15-9n-58e, Fallon County. Pump gage was 369 bbl. of oil and 246 bbl. water per day. The southeast offset was successful for 123 bbl. of oil and 123 bbl. water per day from the same pay. This discovery area is separated by a dry hole from the south end of Cabin Creek field, 1 mile north. It lies about 2 miles northeast of Monarch field production. Shell is currently drilling at 14-14 Government-Hildebrand in C SW SW 14-9n-58e, between this discovery and Monarch. Objective is Ordovician. Monarch field has Silurian oil and some Red River.

A welcome drilling spree is this Cedar Creek development. The increased field-well drilling all along the anticline brightens up the otherwise rather quiet year in the Williston basin. With production figures showing healthy gains each year, the long anticline may well be Montana's biggest producer of oil for a long time.

THIS YEAR'S DISCOVERIES

1. Shell Oil Co.-NPRR M-12-15-NP, SW NW 15-9n-58e, Fallon County, Monarch area: IPP 369 BO, 246 BWPD, 34°, Mission Canyon Mississippian 7,283-7,305 ft.
2. Texaco Inc. 1 NP-G (NCT-12), NE SW 17-16n-54e, Woodrow area, Dawson County. Swabbed 80 bbl. in 3 hours, 50 minutes, or 480 BOPD. Silurian 9,137-46 ft. Gage from Red River Ordovician ot 9,718-33 ft. was swabbed for 157 bbl. in 12½ hours. Installing production equipment.

CURRENT ACTIVE WELLS

1. Shell Oil Co. 13-16 unit state, NW SW 16-14n-55e, Gas City, Dawson County. POP.
2. Shell 33-34 Unit, C NW SE 34-14n-55e, Gas City, Dawson County. MICT. TD 9,025 ft.
3. Texaco Inc. 1 NP "G" (NCT-12), NE SW 17-16n-54e, Woodrow area (see above).
4. Shell 33-19 Unit, NW SE 19-4n-62e, Little Beaver, Fallon County. Swabbing.
5. Shell 44-11 Government-MDU, C SE SE 11-8n-69e, Pennel field, Fallon County. POP.
6. Shell 24-14 Government-Adams, SE SW 14-8n-59e, Pennel field. WOCT. TD 8,974 ft.
7. Shell 33-22 Sinclair et al., NW SE 22-8n-59e, Pennel field. Drilling 8,659 ft.
8. Shell 42-23 Government-Warren, SE NE 23-8n-59e, Pennel field. Testing on pump.
9. Shell 24-24 Government, C SE SW 24-8n-59e, Pennel field. Preparing to run casing. TD 1,032 ft.
10. Shell 14-14 Government-Hildebrand, C SW SW 14-9n-58e, Monarch field, Fallon County. MICT.
11. Shell Oil Co. 42-13-B NP, SE NE 13-12n-56e, Pine field, Prairie County. Preparing to run casing. TD 1,020 ft.

(There are three active locations on the anticline not listed.)

Montana's Dwyer stays active

MONTANA'S Dwyer field is still one of the most active areas in the northern Rockies. Two more producers were added to the Sheridan County field, a third well was testing 12 bbl. hourly and two locations are active.

Signal Drilling & Exploration Co. 1 Brunelle, C SE NW 19-32n-59e, flowed 235 bbl. of oil in 10 hours on final gage from Madison Mississippian perforations at 7,824-27 ft. on 18/64-in. choke. The other new well is Lyda Hunt-Herbert trust 2-A Muller in C SE NW 20-32n-59e. This one pumped 66 bbl. of oil and 3 bbl. water per day from Madison perforations at 7,870-88 ft. The new indicated producer is 1 Hubbell, SE SW 18-32n-59e, another Signal well. This well flowed 12 bbl. per hour during tests through 18/64-in. choke from Madison perforations at 7,857-60 ft.

The two active locations in this northeastern Montana Williston basin field are Phillips Petroleum Co. 1-C Anderson, SE SW 19-32n-59e, preparing to spud; and, Hunt 2 Muller-Delorme in SE NE 20-

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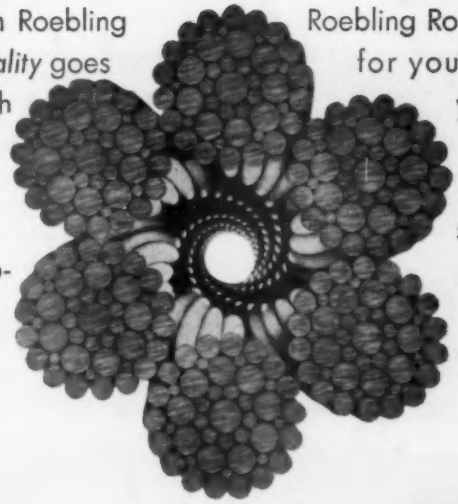

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32n-59e. This one is drilling below 5,817 ft. after skidding the rig from 1 Muller - Delorme, an abandoned test at 7,112 ft. with junk in the hole.

A 1960 strike. Dwyer field was opened last year, but development has been rather slow. There are 14 producers, 10 of them completed this year. The field's producing limits extended west-east for 4 miles and 2 miles north-south. Daily average output in June was 1,000 bbl. Cumulative output to date is more than 213,000 bbl.

Michigan's Jefferson pool extended

In Michigan, Jack Hobson 1 Gardner, NE NE NW 22-7s-15w, Case County, a 1½-mile north step-out to the 700-ft. Traverse pay, Jefferson pool, swabbed 36 bbl. oil over 2-day test period for indicated first important extension of the 1961 opened play.

Hobson's outpost had Traverse lime at 746 ft. with 4-ft. pay at 753 to 754 ft., total depth.

Four wells are producing and five others are testing in the pool, the shallowest oil development in Michigan's history. A 30-bbl. per day limit has been set on the pool by the Conservation Department.

Michigan's Scipio proration reduced

Crude-oil production from the Albion-Scipio Trenton trend field in Michigan averaged 74.1 bbl. per well per day in August and a gross 900,913 bbl. for the month. State field proration was reduced from 125 to 110 bbl. per well as of July 1.

The field apparently peaked in production in May of this year with gross runs of 1,016,296 bbl.

State-wide production in May, the last month for which all-state run figures have been reported, hit 1,662,991 bbl. with the Albion-Scipio trend, discovered in 1957, accounting for 60% of the state total.

The Peters Niagaran reef pool in St. Clair with August runs of 57,752 bbl., presently is second in pool run position to the trend. The well average, however, was only 34.5 bbl. per day in August.

Data released on Mesaverde discovery at Wyoming wildcat

Teapot Mesaverde Cretaceous production is reported at a wildcat in the Shawnee area of Converse County, Wyoming. Discovery well is Tower Oil & Gas Co. 1 Hageman in C NW SW 18-33n-68w.

The well flowed 3 M.M.c.f.d. and 4 bbl. condensate per hour on 16/64-in. choke from perforations at 6,989-7,009 ft. Location is 3 miles south of North Shawnee field. The nearest gas producer is in C SE SE 11-33n-69w. Macson Oil Co. 1 Hall flowed 2,500 M.c.f.d. from Mesaverde perforations at 7,008-18 ft. Two more Mesaverde wells are planned in the new area, one in NW SW 8-33n-68w and one in NW SE 24-33n-69w.

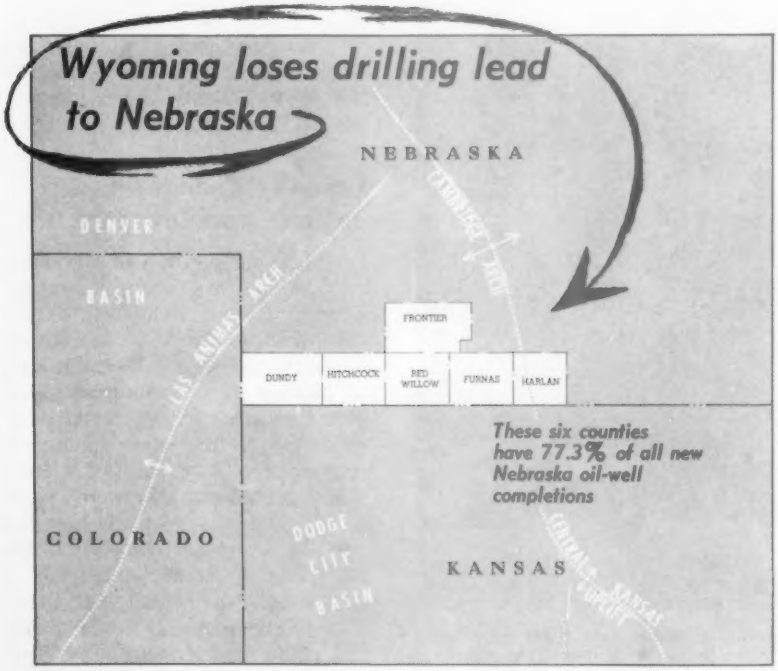
Kentucky drilling slows down in east Lawrence

Drilling activity has slowed down considerably in eastern Lawrence County, eastern Kentucky, as the shallow (1,500 to 1,300 ft.) Mississippian Berea sand production fails to live up to expectations. Initial tests some months ago seemed encouraging as the sand apparently responded well to the notch fracturing technique. However, wells soon settled at a relatively low rate per day. A recent completion has been that of American Oil Co. 1 Preece, 22-P-83 which had Berea 1,721-1,806 with TD 1,829. After perforating and fracturing well is reported as making 6 bbl. oil per day on pump.

THE MICHIGAN PETROLEUM INDUSTRY now has a place with other significant events in the state's history. The metal marker shown here has been set at a new rest stop on Freeway US-27, about 12 miles south of Mount Pleasant. The marker to petroleum is part of the Michigan Historical Commission's state-wide program to identify important events and places.

THIS IS RED WILLOW COUNTY, the busiest drilling arena in th Great Plains-Rocky Mountain province. Pictured is Ohio Oil Co.'s 1 Harsch, that company's first venture in Sleepy Hollo field. The well was completed last year for 415 bbl. of oil daily in Basal sand.

Nebraska takes over first spot in drilling



ALTHOUGH IT ISN'T ON AS GRAND A SCALE, drilling in southern Nebraska's Red Willow County area favors Kingfisher County statistically.

"Busiest area in the Rocky Mountain province . . . that's Southwest Nebraska." This statement has been made several times in the past 18 months. It still holds true.

Wyoming, long the pace-setter in Rocky Mountain regional drilling, has lost its first place to Nebraska. And Nebraska, long active in Denver basin drilling, has shifted its development and wildcat drilling to the southwestern counties in the Cambridge arch country. So far this year operators have drilled 779 wells in Nebraska compared to 764 in Wyoming. At this time last year, Nebraska operators had drilled only 692 wells. Wyoming at this date in 1960 had recorded 815 wells, so it is down from last year's total. The accompanying data sheet shows the swift and successful switch of Nebraska drilling from Denver basin eastward into what used to be on most operators' "don't bother" sheet.

It's all new. The big play going on in southwestern Nebraska is entirely a new venture for northern Mid-Continent operators. The pays are now for Nebraska, the discoveries have opened a new province, and the depths of production are more shallow than those in Denver basin.

This Nebraska success story has

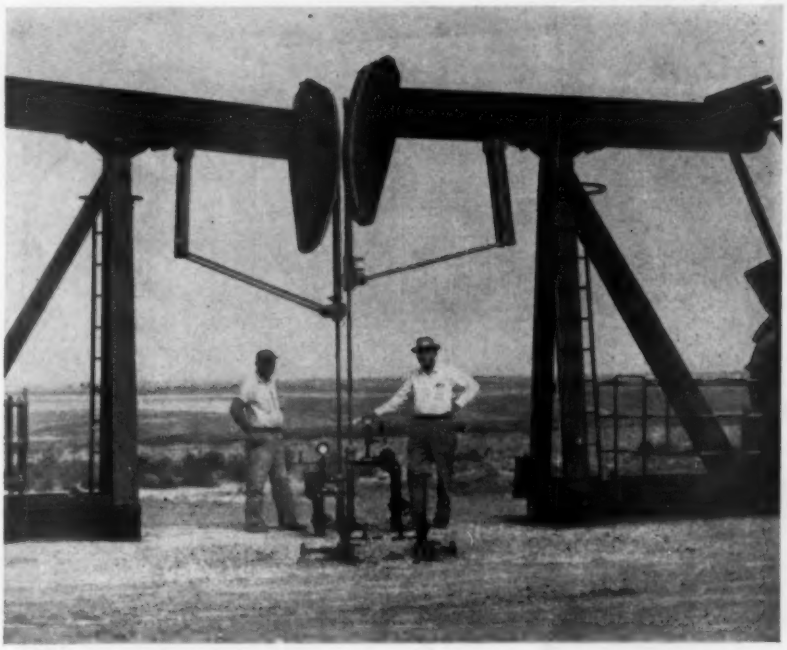
been long in coming. About 3 years ago everyone in the Mid-Continent was talking about the Kan-Neb basin area of northwestern Kansas where several important Pennsylvanian fields were opened, shifting Kansas interest way off the time-worn Central Uplift and Hugoton area. This play soon simmered down.

Then oil was found in Hitchcock County, stirring some. Later the Sleepy Hollow discovery fired one of the region's most active plays since the early days of the Denver basin. Next to Kingfisher County, Oklahoma, Red Willow has seen more new oil wells in the past 18 months than any other county in the Oklahoma - Kansas-Nebraska province. True, the Red Willow play seems to be slowing down from last spring's rapid advance, but drilling continues and dry holes are all but absent.

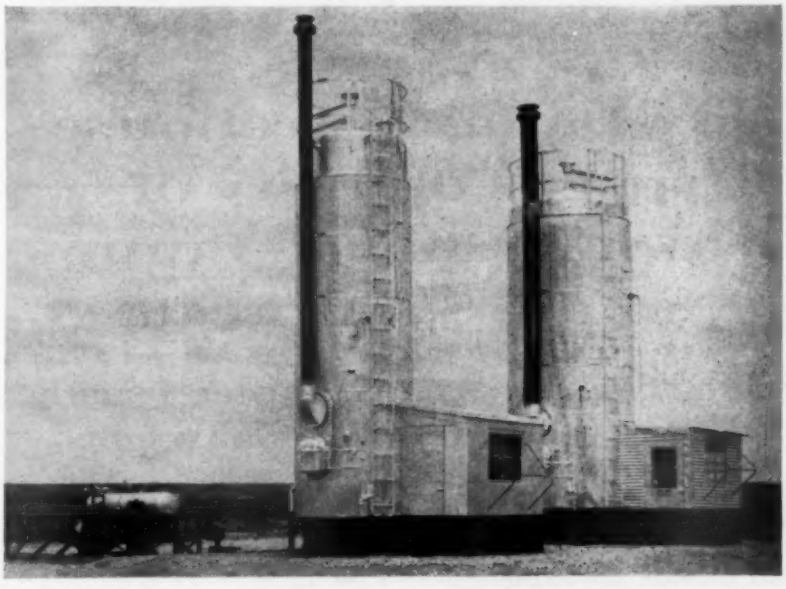
Explorers are now moving into Frontier, Furnas, Dawson, and Lincoln counties, north and east of Red Willow. First production came to Frontier and Furnas this year, and looms now for Lincoln. First oil in Lincoln County would open the gate to the long-beckoning Chadron arch that runs northwestward to northwestern Nebraska—an arch that has seen quite a bit of wildcatting in the past decade, but not one oil well.

Independents' country. Independent operators have flocked into the Southwest Nebraska game. With the decline in Denver basin drilling in the past 2 years, Southwest Nebraska seemed a good way out for many. Drilling is cheap here by regional standards. Producers cost about $40,000, a dry hole $14,000. Average total depth is 3,500 ft., footage rate is $2.50. Average drilling time is 5-7 days. Spacing is 40 acres. Proved acreage to June 1 was 2,680 at Ackman, 5,200 at Sleepy Hollow, and 240 at Silver Creek. These were minimum estimates.

A brief lull. The present slowdown in Southwest Nebraska drilling (from 57 active wells in June at Sleepy Hollow to 19 in October) may only be a short cutback. An important discovery could cause this active location figure to jump back quickly. There is much interest in the Mast Drilling Co. et al. 1 Melton wildcat in Lincoln County where oil

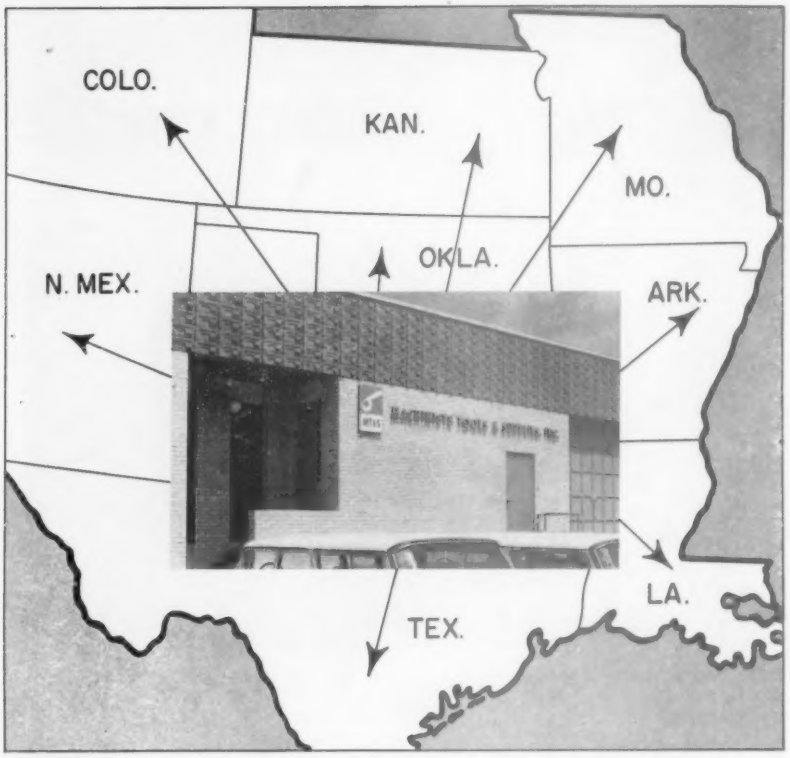


AT THE 3 J. HARSCH WELL, are Foreman R. L. Van Cleave and Pumper Art Chambers. This is a twin-well installation. Production is from both Basal sand and the Pennsylvanian.



THESE ARE Ohio Oil Co.'s treaters for the J. Harsch lease at Sleepy Hollow field. The company has drilled seven wells since the Harsch discovery on its 320 acres in the middle of the field.

THIS IS THE TANK BATTERY on Ohio Oil Co.'s J. Harsch lease in Red Willow County, Nebraska. (Photos courtesy The Beacon, Ohio Oil Co.)



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Southern Nebraska Data Sheet
to 10/14/61

County—	Total field wells	Total field oil wells	Discoveries	Total wildcats	Active locations
Dundy	4	2	5	13	1
Frontier	0	0	1	30	1
Furnas	1	0	1	29	0
Harlan	21	16	1	7	2
Hitchcock	7	3	1	9	1
Red Willow	207	193	7	90	19
Total S. Nebraska	240	214	16	178	24
Total Nebraska	397	277	31	382	35
% in S. Nebraska	60.5	77.3	51.6	46.5	68.5

shows were found on tests of the Cherokee. Swab tests made 6½-10 bbl. per hour at 4,498-4,501 ft. This indicated discovery, if completed as a producer, could really set Nebraska up for another round of wildcatting similar to the one that followed Sleepy Hollow.

The Cambridge arch is big—there's lots of oil-hunting in for the Chadron arch, and the space between the Cambridge arch and Las Animas arch needs many more wildcats. Truly, the southwestern Nebraska area, and indeed the entire central portion of the state, should be checked and double-checked by wildcatters.

This state could well be a big contestant in the Mid-Continent oil game.

DISCOVERIES THIS YEAR

1. Dundy County: Sunray 1 Shafer, C SE NW 31-3n-37w. IPP 35 BOPD, Lansing-Kansas City 4,238-4,442 ft.

2. Dundy County: Sunray 2 Stroup (OWWO), C SE SE 8-2n-37w. IPP 15 BOPD, Admire Permian 3,790-96 ft. and Lansing-Kansas City old perfs. 4,188-4,200 ft. OTD 4,450 ft. Admire discovery, new pay and Permian discovery for Nebraska (not counted in above data).

3. Dundy County: Sunray 1 State-B, C SE NW 36-3n-38w. IPP 47 BOPD, Lansing-Kansas City 4,248-4,304 ft.

4. Dundy County: Sterling Drilling Co. 1 Dunn, C SE NE 31-3n-36w. IPP 95 BOPD, cut 4% water, Foraker Permian 3,824-63 ft.

5. Dundy County: Sunray 1 Ham, NW SE 29-3n-37w. IPP 68 BOPD, Lansing-Kansas City 4,216-4,387 ft.

6. Frontier County: Blair & Associates et al. 1 Zimmer, C NW SW 33-6n-30w. IPP 12 BO, 12 BWPD, basal sand 4,230-40 ft.

7. Furnas County: Exeter Drilling Co. 1 Palmer, C NE SE 17-2n-25w. IPP 131 BOPD, cut 2% b.s. and w., basal sand 3,391-94 ft.

8. Harlan County: Buick Drilling Co.-Pat Simmons 1 Johnson, SW SW 14-1n-18w. IPP 40 BOPD, Lansing-Kansas City 3,366-3,470 ft. Opens Prairie Dog Creek field.

9. Harlan County: W. E. Wickizer 1 Thompson, C NE SW 34-1n-18w. IPP 175 BOPD, no water, 28°, Lansing 3,232-3,350½ ft.

10. Hitchcock County: National Associated Petroleum Corp. 1 Steinke, C NW NW 28-1n-33w. IPP 50 BOPD, Lansing-Kansas City 3,936-4,066 ft.

11. Red Willow County: Murfin Drilling Co. et al. 1 Gallatin, C NW NW 32-3n-26w. IPP 25 BOPD, Lansing-Kansas City 3,324-28 ft.

12. Red Willow County: Champlin 1 Tiller et al., C SW SE 14-3n-27w. IPP 49 BOPD, basal sand 3,403-28 ft.

13. Red Willow County: Midway field; K&E Drilling Co. 1 Boyd, C NW NW 23-1n-27w. IPP 110 BOPD, Lansing-Kansas City 3,214-26 ft.

14. Red Willow County: Silver Creek field. Burch Drilling Co. 1 Haag, C NW NW 19-2n-26w. IPP 210 BOPD, some water, Cherokee Pennsylvanian 3,520-49 ft. New pay.

15. Red Willow County: Simmons Oil Co. et al. 1 Fischer, C NE NW 25-2n-27w. IPP 126 BOPD, cut 20% water, Lansing-Kansas City 3,363-72 ft.

16. Red Willow County: Tipps Drilling Co. et al. 1 Haag, C NE NE 31-2n-26w. IPP 96 BOPD, cut 1% water, Lansing-Kansas City 3,270-3,440 ft.

17. Red Willow County: K&E Drilling Co. 1 Bastian-B, C NE NW 12-1n-28w. IPP 45 BO, 13 BWPD, Lansing-Kansas City 3,313-25 ft.

New test hunts deep gas at Arkoma's Alma field

AN ATTEMPT to extend deep gas production found earlier this year off the side of the old Alma shallow-sand gas field in Crawford County, in northwest Arkansas, is being made by Ambassador Oil Corp., discoverer of the deep gas.

Ambassador's new operation is southeast of the old shallow field and about 1½ miles northeast of the company's deeper-pay discovery well.

The latter well, 1 Kreuger, completed last June, is productive from the Atoka-Barton sand, perforated at 4,978-88 ft. It was rated good for 600 M.c.f.d. of gas with flowing pressure of 1,000 psi. It also had indications of production from shallower Lower Alma sand, perforated at 2,373-2,458 ft. for a dual completion, but failed to produce from that zone.

Location of the new test, 1 F. E. Shearer unit, in the NE SE SW 9,9n-30w, is a mile east of Alma townsite, east of Van Buren. It is set up as a 5,900-ft. Hale test.

Seventh well extends East Texas Leona field

Production of the steadily developing Leona Sub-Clarksville field, in southern Leon County, East

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Texas, has been extended nearly a mile northwest.

The extension well, D. H. Byrd 1 Elizabeth Nash, is the seventh for the field, opened last April by J. W. McFarland and Gibson Drilling Co. It flowed at the rate of 249 bbl. of 38°-gravity oil daily through ¼-in. choke. Flowing pressure was 1,075 psi., and gas-oil ratio 1,100 cu. ft. per bbl.

Its Sub-Clarksville pay is perforated at 6,977-86 ft. with casing at 7,048 ft. Total depth is 7,060 ft. Byrd already is drilling on another location a quarter mile west.

Two discoveries swell Louisiana's field list

Two more gas discoveries were reported in coastal Louisiana last week to boost that region's ever lengthening list of fields.

One, by F. A. Callery, Inc., is just a short distance inshore from the Gulf of Mexico in Cameron Parish, in the southwestern tip of the state. It is 3 miles southeast of Cameron Meadows field, and about the same distance south of the one-well Second Bayou field.

The other, by Texas Gulf Sulphur Co., is on the west side of the more inland Jefferson Davis Parish. It is 2 miles east of Iowa field, which straddles the Jefferson Davis-Calcasieu parish line.

Callery's well tested 1,900 M.c.f. of gas with 9 bbl. of 47.2°-gravity condensate daily, flowing through 14/64-in. choke under 2,800 psi. pressure. Production is from a 10,004-ft. sand in hole drilled to 12,834 ft.

Texas Gulf Sulphur's well flowed 925 M.c.f. of gas with 1 bbl. of 57.9°-gravity condensate daily, also through 14/64-in. choke. Pressure registered 1,076 ft.

Pacific announces discovery of new oil field in Alberta

In Canada, Pacific Petroleums, as operator for the group of equal owners consisting of Pacific, California Standard, and British American, announces the discovery of what appears to be another oil field in the Kaybob reef 5 miles east of Kaybob oil field, Alberta.

The well, known as Pacific 10-4 Kaybob, is located in LSD 10, 4-64-18w5 in the central part of an 8-section lease block, which is part of a checkerboard of such blocks owned equally by the three companies.

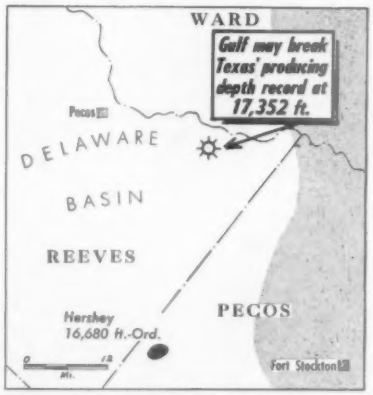
Kaybob 10-4 flowed clean 45.5°-gravity oil on drill-stem test at the rate of 17 bbl. per hour from the interval 9,606-96. A subsequent test of the interval 9,694 to 9,721 recovered 45 ft. of clean oil; a final test 9,721-46 ft. recovered 1,340 ft. of salt water.

The group is preparing to follow up the discovery by the immediate drilling of development wells, using two rigs.

Wildcat in shallow field may break Texas producing-depth record

A scheduled 18,700-ft. wildcat inside shallow Worsham field, Reeves County, West Texas, may break the current producing-depth record in Texas. Gulf Oil Corp. 2 R. Cleveland et al., 13 miles southeast of Pecos, is drilling ahead below 17,362 ft. after flowing gas on a drill-stem test in the Ellenburger Cambro-Ordovician.

The test at 17,248-17,352 ft., open 2½ hours, had gas to the surface in 18 minutes and after 1 hour was flowing 11,400 M.c.f.d. Volume at the test's end was 10 M.M.c.f.d. Location of this important Delaware basin discovery is in Section 50, Block 5, H&GN Survey. There is no deep production any closer than Rojo Caballos, nor is there any previous deep drilling nearby.



SHALLOW Worsham field in Reeves County, West Texas, may be the scene of Texas' deepest producing well.

Remote wildcats slated for two Nebraska counties

Thomas and Custer counties in north central Nebraska will have five wildcats this month. Muir-Thompson Inc. of Topeka will drill a granite test on a farmout from Arawak Corp. of Sedalia, Mo. This is located in the SW¼ 13-24n-28w, on the David Beckhoff ranch, 6 miles north of Thedford in Thomas County.

Rains and Williamson of Wichita will drill a granite test in the NW SW¼ 4-23n-26w, Thomas County. In Custer County, M. W. Volentine Co. and Murfin Drilling Co. staked two wildcats in the Broken Bowl area in 33-15n-21w and 30-15n-28w.

Small pool find indicated in Lawrence County, Ohio

In Ohio, indications of a small pool opener was reported by Harvey Star on final testing of 1 Frank Herrell, Section 24, Symmes Township, Lawrence County. It had a showing of gas natural from the Clinton sand from 3,189-3,223 ft. and finaled at 148 M.c.f.d. with a rock of 570 psi. 3 months after fracture.

Star has a deep test started here about 1 mile north of this location on 1 A. J. Payne, Section 13.

In the Cambellsport area, East Ohio Gas Co. mover more than ½ mile southwest to complete a good producer in Rootstown Township, Portage County. The 1 R. H. Bower, Section 4, had 141 M.c.f.d. natural and after fracture gaged 1,302 M.c.f.d. with a rock of 1,350 psi. The Clinton sand was logged at 4,438-4,506 ft.

Ohio's Friendsville pool moves into Lafayette

In Ohio, King Drilling Co.'s ½-mile stepout across the township line, extended Friendsville pool into Lafayette township, Medina County.

Natural gage of 1 Neal T. Neise, Tract 3, Lot 5, in the Clinton sand from 3,175-3,225 ft. was 238

M.c.f.d. It gaged 3,900 M.c.f.d. after fracture with a rock pressure of 1,200 psi.

• East Ohio Gas Co. added another good producer to Campbellsport pool in Charlestown township, Portage County. Reported flow of 1 Johns Sveda, Lot 2, after fracture was 4,147 M.c.f.d. from the Clinton sand logged at 4,283 - 4,355 ft. Three-day rock was 1,420 psi.

Rare Ordovician wildcat slated for Montana's Powder River

The Montana portion of the Powder River basin, largest basin in Wyoming, will see an important 11,500-ft. Ordovician wildcat drilled. This new test will be Gulf Oil Corp.'s 1 Bales in C NE NW 11-9s-45e, Powder River County.

There has never been much pre-Pennsylvanian drilling either in the Montana portion of the basin or in the northern part of Wyoming's Powder River area. Gulf drilled a 9,062-ft. Deadwood Cambrian test at 1 Boyle in NW SE 4-8s-52e in 1952 in the Biddle area of Powder River County. There were no shows. Lander sand of Ordovician age was topped at 8,950 ft. The only test made was in the Mississippian. Nearest other deep drilling was 10 miles south in Sheridan County, northern Wyoming. Shell Oil Co. drilled a 12,215-ft. dry Cambrian test in the Clear Creek sector at 1 Clear Creek, C NW SE 11-57n-78w. This was drilled 12 years ago. There was some slight oil shows in Pennsylvanian rocks and below. The only tops reported were Minnelusa Pennsylvanian at 10,170 ft., Mississippian 10,644 ft., and Cambrian at 11,970 ft.

DISCOVERIES

ARKANSAS

Franklin County:

Gulf Oil Corp., 1 T. C. Drake, 14-8n-29w. IP 3,025 M.c.f.d. (calculated open-flow potential), shut-in TP 550 psi., perf. 3,060-80 ft. and 3,111-21 ft., Atoka-Morris sand. TD 6,850 ft. Deeper-pay discovery ¾ mile southwest of Vesta shallow gas area.

WESTERN CANADA

Alberta:

Pacific 10-4 Kaybob, LSD 10, 4-64-18w5. Beaverhill Lake oil discovery. TD 9,812 ft.

Brett et al. 5-25 Taber, LSD 5, 25-9-17w4. Sunburst oil discovery. TD 3,373 ft.

Union Texas 1 Hillsdown, LSD 1, 27-37-25w4. D2 oil discovery. TD 6,691 ft.

Whitehall et al. 6-30 Key Pembina, LSD 6, 30-47-1w5. Cardium oil discovery. TD 4,080 ft.

Altana-Plymouth 10-30 Raven River, LSD 10, 30-35-5w5. Viking gas discovery. TD 9,480 ft.

Pnalta-Empire State 7-15 Drumheller, LSD 7, 15-29-20w4. Glauconitic gas discovery. TD 5,650 ft.

CPOG 11-28 Parkland, LSD 11, 28-15-26w4. Mississippian gas discovery. TD 8,520 ft.

Hunt 14-12 Ferrier, LSD 14, 12-39-8w5. Cardium oil discovery. TD 7,230 ft.

Imperial 10-29 Chedderville, LSD 10, 29-37-7w5. Cardium oil discovery. TD 12,016 ft.

Husky 10-32 Holden, LSD 10, 32-50-15w4. Viking gas discovery. TD 2,320 ft.

NNGPO et al. 1-A Willisden Green, LSD 6, 5-43-7w5. Cardium oil discovery. TD 6,480 ft.

LM 11-33 Turin, LSD 11, 33-10-18w4. Basal Blairmore oil discovery. TD 3,822 ft.

Mobil WCT 7-28 Carson, LSD 7, 28-61-12w5. Beaverhill Lake oil discovery. TD 8,767 ft.

NUCO 10-28 Edgerton, LSD 10, 28-45-4w4. Viking oil discovery. TD 2,473 ft.

SASKATCHEWAN

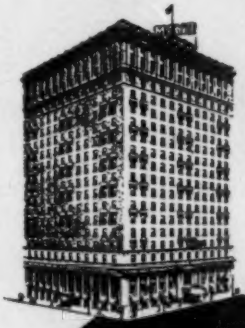
Mobil X1-4 East Grassdale, LSD 1, 4-8-15w2. Mississippian oil discovery. TD 4,587 ft.

COLORADO

Logan County:

A. T. Skaer 1 Carey, OWDD OTD 5,155 ft. SW NW 26-9n-53w. IPF 1,449 M.c.f.d. and 6 bbl cond. per day, 21/64-in. choke, "J" sand 4,905-9 ft. TD 5,155 ft. "J" sand discovery, new field.

THE HOTEL



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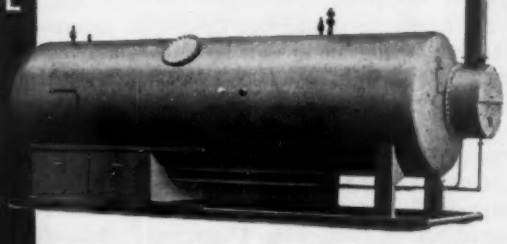

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PROFILE

William P. Clements, Jr. and Charles H. Todd
New AAODC president and national vice president

Drillers' aim: Sound practices

New AAODC officers would prevent "needless" contractor failures by eliminating "unreasonable contract demands."

WILLIAM P. Clements, Jr. and Charles H. Todd map bold action for the American Association of Oilwell Drilling Contractors during 1962.

Their purpose: Make sure fitness, not luck, determines which contractors remain in business.

When Clements takes office as AAODC president and Todd becomes national vice president on January 1, they will figuratively hit the ground running. Their drive started late in 1960 when Clements organized the Association's Sound Practices Committee to attack the problem of needless contractor bankruptcy. Both—as AAODC directors for many years—have been instrumental in making "Sound Practices" the theme for 1962.

As these men see it, some contract-drilling firms fail even in the best of times. Because the years since 1957 have been near the worst of times for drilling contractors, mortality rate has been high. Most regrettable facet of this situation is that many firms which failed were better than average drillers whose luck simply ran out. Clements and Todd say that oftentimes these firms fell victim to unreasonable demands of the producing oil companies—that the producers asked the contractors to take more risk than the producer was willing to pay for.

Result: Fit contractors failed; those less fit whose luck held remained in business. This situation, the new AAODC officers say, is unhealthy for all.

Clements and Todd plan positive action to rectify the problem:

A concerted membership drive to get all contractors into AAODC where they can be better alerted to the dangers of taking uncompensated risks.

An educational program to convince producing oil companies of the folly of their unreasonable demands on contractors.

Stimulating supply companies to take a closer look at the danger they face as a result of some contractors' practices. Since most contractors are heavily in debt to supply companies, the supplier assumes the same risk the contractor does.

In addition, Todd and Clements say they hope AAODC can serve as a catalyst to contracting companies in bringing stability to the work week and wages of drilling crews.

Southeastern's president. Clements accepted the AAODC reins knowing he would have to sacrifice time from his job as president of Southeastern Drilling Corporation, Dallas. Since the company's modest start in 1947, he has propelled Southeastern into an international driller with rigs onshore in South Louisiana, offshore in the Gulf of Mexico, in Argentina, Pakistan, Kuwait, and Iran.

Clements is also active in IPAA and the Texas Mid-Continent Oil & Gas Association. He serves on the national executive board of the Boy Scouts of America and on the development board of Southern Methodist University.

R. W. Rine's head man. Todd has been a partner in R. W. Rine Drilling Co. since 1920. He has been president of the firm almost 20 years. Exclusively a rotary contractor since 1935, the firm operates rigs in Oklahoma, Kansas, the Texas Panhandle, Utah, and other Rocky Mountain states. A subsidiary drills in Canada.

Todd has been a director of AAODC since 1948 and was a regional vice president during 1961. He is also a director and member of the executive committee of IPAA.

●

Serving with Clements and Todd (above) as AAODC officers are **E. Dale Mount,** Dale Mount Drilling, Inc., Dallas, secretary-treasurer; **Joseph M. Shelton,** Lyne, Blanchette, Smith & Shelton, Dallas, general counsel; and **Warren L. Baker,** executive vice president. Vice presidents and their areas or specialties are **F. M. Stevenson,** Signal Drilling & Exploration, Denver, cable tools; **John Ed Cooper,** BBM Drilling Co., Midland, Tex., West Texas and New Mexico; **Norman Haney,** Haney & Williams Drilling Co., Long Beach, Calif., California; **John R. Burns, Jr.,** Burns Drilling Co., Evansville, Ind., Illinois, Indiana, Michigan, and Kentucky; **C. B. Webster,** C. B. Webster Drilling Co.,

Houston, Texas Gulf Coast; **Baker Littlefield,** Power Rig Drilling Co., Lafayette, La., Louisiana-Mississippi Gulf Coast; **Fred E. Stickle,** Stickle Drilling Co., Tulsa, Central Mid-Continent; **M. D. McBride,** Camay Drilling Co., Denver, Rocky Mountains; **J. J. Harrigan,** Standard Drilling Co., Oklahoma City, well servicing; **J. K. Maxwell,** Carter-Jones Drilling Co., Kilgore, Tex., cretaceous and tertiary basins; **James H. Phillips, Jr.,** King-Phillips, Inc., Fort Worth, North and West Central Texas; and **George H. W. Bush,** Zapata Off-Shore Co., Houston, offshore.

C. J. Struble, Chicago, manager of nitrogen products sales for American Oil Co., has joined Tuloma Gas Products Co., an affiliate, in Tulsa as vice president, nitrogen products, and a director.

F. C. Jones has been promoted to assistant manager of Venezuelan operations in Phillips Petroleum Co.'s exploration and production division, international department. He will continue as head of the operating department in Caracas.

J. H. PEW

J. Howard Pew, director and former president of Sun Oil Co., was honored at a dinner last week for 60 years' service to the firm. Pew is the second man in company history to receive a 60-year pin. He joined Sun in 1901 and served as its president from 1912 to 1947. The service pin was presented to Pew by his brother, **J. N. Pew, Jr.,** chairman.

Irvin Kranzler, Shell Oil Co., has been elected 1961-62 president of the Billings, Mont., Geological Society. Other new officers include **Charles F. Olson,** McAlester Canadian Oil Co., first vice president; **Marvin Heany,** Northern Natural Gas Producing Co., second vice president; **G. William Hurley,** Pan American Petroleum Corp., secretary; and **R. K. Nunley,** Amerada Petroleum Corp., treasurer. **Larry T. Hart,** Humble, and **Richard M. Model,** Northern Pacific Railway, will be directors.

W. L. Jessup was elected president of Alabama Oil Jobbers Association, and **L. B. Paine** was picked to head Mississippi Oil Jobbers Association at the groups' joint convention recently in Mobile, Ala.

Alberta Oil and Gas Conservation Board has appointed **D. R. Craig** administrator of oil in the province and **J. G. Stabback** as administrator for gas.

Ralph E. McConnell has been named superintendent of the cracking department at Gulf Oil Corp.'s Philadelphia refinery. He succeeds **Jack W. Burk,** recently named manager of operations there.

Monroe J. Rathbone, president of Standard Oil Co. (N. J.), will receive American Institute of Consulting Engineers' 1961 award of merit. Presentation of the award will be made October 17 in New York during the group's annual dinner.

K. M. Watson has been named executive assistant to the president of Cia. Shell de Venezuela. He will also be a director of the company. Watson has been with the Shell companies since 1936. He was manager of the materials division for Shell in London and then coordinator for the Caribbean and Central American zones before the new appointment.

Eger V. Murphree, president of Esso Research & Engineering Co., has been named chairman of a national committee formed to plan the U. S. oil industry's participation in the sixth World Petroleum Congress, which will be held in 1963 in Frankfurt, Germany. **Dr. Jerry McAfee,** Gulf Oil Corp., and **Howard B. Nichols,** California Texas Oil Corp., are vice chairmen. Other committee members are **H. Gershinowitz,** Shell Development Co.; **G. F. James,** Socony Mobil Oil Co.; **Dr. W. E. Kuhn,** Texaco; **H. D. Hedberg,** Gulf; **G. Roberts, Jr.,** Pan American Petroleum Corp.; **A. F. Kaulakis,** Esso Research; **A. L. Lyman,** California Research Corp.; and **Dr. C. L. Thomas,** Sun Oil Co. **Dr. B. C. Belden** will be committee secretary and **William M. Craig** will be public relations manager. Both are with Esso Research.

PERSONALS

Thomas C. Barger, president of Arabian American Oil Co., will become chief executive officer December 1 after retirement of **Norman Hardy,** chairman. **Paul H. Arnot,** vice president for operations and a director, and **R. I. Brougham,** vice president for government relations and finance, have been named senior vice presidents of Aramco. **J. H. McDonald** has resigned as vice president, secretary and a director. He will retire at the end of the year. **J. J. Johnston,** assistant secretary and assistant general manager of the New York office, will succeed McDonald as general manager of the New York office. **R. M. Henry,** assistant to the vice president of government relations, will succeed Johnston. Barger, new chief executive officer, has been with Aramco 24 years. He went to Saudi Arabia in 1937 as a geologist. Barger succeeded Hardy as Aramco president in 1959.

BARGER

ARNOT

BROUGHAM

Hamilton P. Caldwell, vice president of manufacturing for Mobil Oil Co. de Venezuela, has been appointed manufacturing manager of Mobil International Oil Co. **B. W. Hurst,** manager of Mobil Oil Co.'s retail merchandising department, has been named marketing manager for Mobil International. **R. M. Urquhart,** international wholesale sales manager of Mobil International in New York, has been appointed general manager of Mobil Oil Danmark. He will move to Copenhagen in November. **Stig Host,** managing director of Mobil Sales (International) Ltd. in Tokyo, will succeed Urquhart in New York.

J. W. McDonald head of Shell Oil Co.'s eastern division in Pittsburgh, has been named exploration manager for the Casper, Wyo., division. He succeeds **J. F. Bookout,** who has been transferred to Shell's head office in New York. McDonald has been with Shell since 1941. He has served as division geologist in Wichita Falls, Tex., Colorado division exploration manager, and area geologist in Denver and Los Angeles.

McDONALD

Sol Meltzer, district geologist for Canada - Cities Service Petroleum Corp. in Calgary, has been transferred to Bartlesville, Okla., as geologist on the southern region staff of Cities Service Petroleum Co.'s exploration division.

Bruce H. McCully, former general manager of Cooperative Refinery Association, Kansas City, has joined National Cooperative Refinery Association as manager of the crude-oil division. He succeeds **J. E. Vilm.** Vilm will continue with the company in an advisory capacity until he retires December 31.

Hallan N. Marsh, Whittier, Calif., petroleum consultant, received the AIME Society of Petroleum Engineers' John Franklin Carll award last week at the group's Dallas meeting. The Carll award recognizes distinguished achievement in petroleum engineering or contributions to the field.

A new Oil and Gas Conservation Commission has been set up by Pennsylvania Governor **David L. Lawrence.** In addition to **Lewis E. Evans,** secretary of mines and mineral industries, committee members are **W. Floyd Clinger,** Warren, Pa., independent operator, representing independent oil interests; **Thomas G. Johnson,** Shell Oil Co., representing the majors; **William E. Snee,** Snee & Eberly, independent gas; **Charles P. Duncan, Jr.,** Manufacturers Light & Heat Co., major gas utility; **James R. Wylie,** Benedum Trees Oil Co. and Hiawatha Oil & Gas Co., nonutility gas; and **Harold J. Magner,** Delta Drilling Co., representing independent interests, oil or gas. Clinger and Snee will serve 6-year tearms. Wylie and Magner have been appointed to 4-year terms, and Johnson and Duncan will serve for 2 years.

Bryan E. Mitchell, Jr., gas marketing superintendent in Pan American Petroleum Corp.'s Tulsa office, has been named gas development superintendent for the Texas-Louisiana Gulf Coast division in Houston.

E. E. Clapham, Gulf Oil Corp.'s district reservoir engineer in Midland, Tex., has been named Monahans, Tex., area engineer. **J. N. Newmeyer,** senior petroleum engineer in Midland, will succeed Clapham. **E. A. Ehlers, Jr.,** has been named district reservoir engineer in Houston. He succeeds **C. F. Kalteyer,** now district production engineer there. Kalteyer replaced **Z. C. Ballinger,** who has been transferred to Hobbs, N. M., as area engineer. **C. M. Bumpass,** formerly Hobbs area engineer, has been transferred to Kilgore, Tex., in the same capacity. **C. W. Alcorn, Jr.,** area production geologist, has been transferred to Victoria, Tex., from Andrews, Tex.

C. W. Leisk, executive vice president of Austral Oil Exploration Co., Inc., has been elected president. He succeeds **R. McLean Stewart,** who becomes chairman.

Lorne A. Smith, deputy producing coordinator for Standard Oil Co. (N. J.) in New York, has been named general manager of International Petroleum Co.'s Peruvian operations. He will headquarter in Lima. Smith succeeds **Jack Ashworth,** who has resigned.

Marshall Brown, Louisiana area manager for Monterey Oil Co., has been named gas sales manager in Humble's southeastern region supply and transportation department. **O. C. Day, Jr.,** assistant manager of crude-oil purchasing in Shreveport, La., has been named crude and condensate sales manager.

S. M. Whitehill, marketing department operations manager in Humble's Denver office, has been named marketing operations manager for the 20-state central region in Tulsa. Whitehill has been with the Standard Oil (N. J.) companies since 1941. He was sales manager in Denver before becoming marketing operations manager there.

DEATHS

Harold R. Moorhouse, 58, executive vice president and treasurer of Arthur G. McKee & Co., died October 1 in Cleveland. Moorhouse had been executive vice president of the company since 1958. He recently was named administrative executive vice president and chairman of the executive committee. He joined the McKee company in 1929.

Donald B. Edwards, 51, Tulsa gas consultant, died October 6 in a Tulsa hospital. Edwards had been with Continental Oil Co. and Pan American Petroleum Corp. before becoming a consultant. He was sales superintendent for Pan Am when he left the firm in 1959.

J. C. Ohaver, 79, Tulsa independent operator, died October 9 at his home after a long illness. Ohaver, an organizer of International Petroleum Exposition, had been semiretired for several years.

J. Emory Harrell, 55, Casper, Wyo., division sales manager for Lee C. Moore Corp., died October 2 in Casper after a heart attack. Harrell had been with Moore since 1922 serving in Dallas, El Dorado, Ark., Shreveport, La., and Longview and Abilene, Tex., before moving to Casper.

Percy Sprague, 42, president of Sprague Oil Co., Olney, Ill., died October 3 in a Chicago hospital after major surgery. Sprague was with Pure Oil Co. in Olney before setting up Sprague Oil.

Four Marathon Pipeline Co. employes were killed October 9 in a fire at Marathon's Bridgeport, Ill., station. Dead are **M. L. Magee,** 58, chief engineer of the Bridgeport station; **James W. Neeley,** 56, district gauger; **George L. Askren,** 59, and

N. M. L. Watson has been elected vice president and a director of Asiatic Petroleum Corp. He will also serve as assistant to the president. Watson joined Shell Petroleum Co. in London in 1937. He was manager of Shell's South European area department in London before joining Bataafse Internationale Petroleum Mij., The Hague, in 1959 as area coordinator for South Europe. He was acting area coordinator for North Europe before the new appointment.

Leonard L. Limes, consulting geologist, has been elected 1961-62 president of New Orleans Geological Society. Serving with Limes will be **James M. Bibee,** Gulf Oil Corp., vice president; **L. David Collier,** Hudson Gas & Oil Corp., secretary; **Robert J. Ingram,** The California Co., treasurer; **Lyle H. Harvey,** John W. Mecom, director, 3-year term; and **Harold N. Hickey,** California Co., director, 2-year term.

Preston P. Nibley, manager of operations for Trans-Arabian Pipe Line Co. in New York has joined Socony Mobil Oil Co.'s engineering department as an engineering consultant.

Harry Lee has been named assistant general superintendent of Ohio Fuel Gas Co.'s gas measurement department.

James N. Shrader has been appointed vice president of Southern California Gas Co. He will be responsible for coordinating the company's operating divisions.

Perry E. Moore, dispatcher coordinator for Northern Natural Gas Co. in Hugoton, Kans., has been promoted to pipeline superintendent in Garden City, Kans.

B. R. Swanson, staff assistant to the Los Angeles transportation manager of Tidewater Oil Co., has been named assistant transportation manager. He succeeds **I. E. Chapman,** who has retired after 32 years of service.

C. O. Walker, division engineer for El Paso Natural Gas Co. in Farmington, N. M., has been transferred to the home office in El Paso, Tex., as staff engineer. **L. M. (Bill) Parrish** will succeed Walker in Farmington.

John B. Krizer, assistant manager of Cities Service Petroleum Co.'s supply and distribution division, has been promoted to manager, supply and distribution. He succeeds **G. C. Richardson,** who recently was promoted to assistant coordinator of light-ends products for the Cities Service system. Krizer joined Cities Service in 1934. He was assistant sales manager in the refining division before moving to the supply and distribution division.

KRIZER

Willard F. Connolly, manager of marketing services for Plymouth Oil Co., has been appointed manager of retail sales. He will headquarter in Houston.

B. G. Jones has been named refinery-technology superintendent at Tidewater Oil Co.'s Avon refinery near San Francisco. **C. K. Viland** has been named petrochemical development superintendent there. Also, **S. A. Bordi** has been named isocracker coordinator at Avon, and **F. C. Draemel** has been named refinery-technology supervisor.

Walter Burton, 53, pipeliners. Three others were hospitalized by the fire, which was the worst disaster in the history of Ohio Oil's pipeline operations.

Ernest Eugene Berglund, 58, internal auditor for Indiana Oil Purchasing Co., died October 7 in a Tulsa hospital.

Arthur Glenn Evans-Lombe, 59, sales executive with Iverson Supply Co., died September 27 at his home in Fort Worth of an apparent heart attack. Evans-Lombe had been vice president and sales manager of Parkersburg Rig & Reel Co. and a superintendent of Moody Seagrave Oil Co. before joining Iverson last year.

John Sherman (Red) Leonard, 53, former Tulsa division manager for Ohio Oil Co., died October 10 in Tulsa after a heart attack. Leonard was named special representative in Ohio's Findlay, Ohio, general office September 1 after 6 years in the Tulsa post. Leonard had been with Ohio 31 years. He was assistant division manager in Casper, Wyo., before moving to Tulsa.

Roy E. Kimsey, Sr., 68, retired regional sales manager for Hughes Tool Co. in Midland, Tex., died September 29 in Midland after a long illness.

Alexander W. Major, 83, pioneer oil and gas operator in Texas' Jim Hogg County, died October 3 in Laredo, Tex., after a long illness.

Ralph G. McIntyre, 60, chairman of Four Corners Pipe Line Co., and retired chairman of Standard Oil Co. of Texas, died of a heart attack October 8 while visiting relatives in Wilton, Conn. McIntyre was president of Standard of Texas before becoming chairman in 1955. When he retired from the company in 1957 he was also president of two subsidiaries, Pasotex Petroleum Co. and Pasotex Pipeline Co.

S. K. Makemson, vice president and general sales manager of John Wood Co.'s Bennett Pump division, died October 7 at his home in Muskegon, Mich., after a heart attack.

William A. Ryan, 82, retired Tulsa independent operator, died October 10 at his home after a long illness.

O. Paul Beretz, 56, financial analyst for Panhandle Eastern Pipe Line Co., died October 4 in Kansas City.

Leo W. Rice, 46, owner of International Air Drilling Engineering, Inc., Denver, died October 3 in a Denver hospital after a short illness.

Otis Fehl Cozier, 64, Tulsa, southwestern manager of Palmer Publications, publishers of World Petroleum, died October 7 while on a business trip to Houston. He had been with the publishing firm since 1942.

Statistics

Well-completion peak lags rig peak by about 2 months

	1956		1957		1958		1959		1960		1961	
	Rigs*	Wells†	Rigs*	Wells†	Rigs*	Wells†	Rigs*	Wells†	Rigs*	Wells†	Rigs*	Wells†
Jan.	2,635	4,337	2,337	4,442	2,016	**4,407**	1,881	3,912	1,691	3,542	1,595	**3,209**
Feb.	2,482	3,894	2,294	3,515	1,934	2,875	1,816	2,817	1,670	2,532	1,518	2,532
Mar.	2,647	3,632	2,425	3,328	1,767	2,743	1,920	3,097	1,667	2,972	1,600	3,247
Apr.	2,689	4,078	2,391	3,295	1,805	2,532	2,071	3,446	1,793	2,447	1,631	2,802
May	2,724	4,565	2,345	4,241	1,800	3,515	2,146	3,282	**1,822**	2,841	1,765	3,463
June	**2,756**	3,896	2,464	3,150	1,821	3,176	**2,242**	3,327	1,789	3,602	1,793	2,985
July	2,622	4,069	2,526	3,638	1,797	3,586	2,200	**3,989**	1,714	3,199	**1,832**	2,963
Aug.	2,523	**4,602**	**2,530**	4,638	1,895	3,052	2,132	3,454	1,701	**3,785**	**1,855**	3,290
Sept.	2,526	3,580	2,497	3,867	1,912	3,601	2,123	3,851	1,746	2,725	**1,853**	2,939
Oct.	2,551	4,192	2,405	**4,736**	1,972	3,303	2,076	3,242	1,736	3,017		
Nov.	2,572	3,832	2,388	3,501	2,078	4,112	2,158	3,312	1,805	2,990		
Dec.	2,716	3,767	2,495	3,847	**2,260**	3,592	2,095	3,893	**1,843**	3,416		

*Operating rotary rigs, Hughes Tool Co. †Rotary completions.

Fourth-quarter completions will be up

BY JOHN C. CASPER

IT IS AXIOMATIC that shifts in the number of operating rigs bring changes in rotary-well completions per month. But, there are two questions for which the answers are not quite so self-evident. They are:

1. What is the lag between increased rig activity and the boost in completions?

2. How big must the rig increase be to give a measurable gain in well completions?

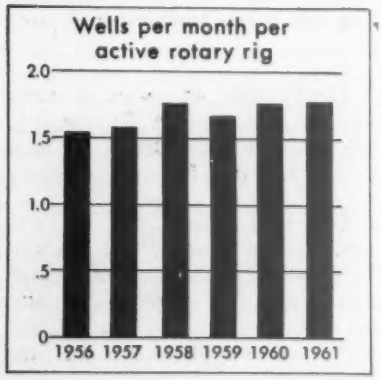
The table on this page gives at least a partial answer to these questions. Follow the figures in boldface type. They represent peaks each year in rotary rigs and rotary completions. Rotary-rig totals are from Hughes Tool report and rotary completions are total completions minus cable-tool completions as shown on the Journal's monthly well-completion report.

For the years 1956 and 1957, peaks in rotary completions came 2 months after peaks by rotary rigs. The lag in more recent years has varied from 1 to 3 months.

In some cases the rig peak may be at the end of the year, to be followed by a high-completion month early in the following year. Increased rig activity during November and December last year resulted in higher completion rates for December and January.

There were only 3 months last year with rig activity above 1,800. The peaks were in May, November, and December. There have been only three above 1,800 months so far this year, but all of them were in the third quarter.

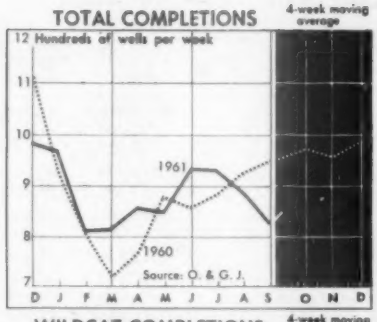
Completion rates should begin to show the effect of this increased rotary activity. Total rotary completions for the fourth quarter will be about 5.4 times the average number of rotary rigs operating in September, October, and November. What is your estimate?

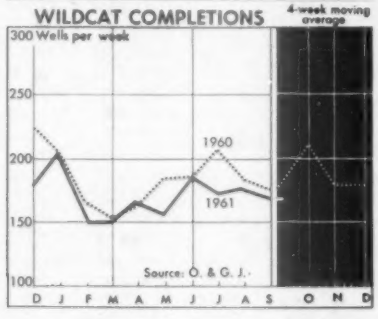


A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,123,050	DOWN	74,100	UP	176,173
Crude stocks	251,982,000	UP	1,262,000	UP	20,109,000
Completions	937	UP	162	UP	10
Refinery runs	8,155,000	UP	*54,000	UP	275,000
Gasoline stocks	185,110,000	UP	626,000	DOWN	3,532,000
Kerosine stocks	36,265,000	UP	475,000	UP	1,144,000
Distillate stocks	166,438,000	UP	299,000	DOWN	4,999,000
Residual stocks	50,080,000	DOWN	140,000	DOWN	686,000
Four-product stocks	437,893,000	UP	1,260,000	DOWN	8,073,000
Total imports	1,301,800	DOWN	*728,600	DOWN	269,200

*Data for 9-29 revised.





Active rotary rigs

	10-9-61	10-2-61	10-10-60
Alabama	3	3	2
Alaska	13	13	7
Arkansas	16	17	12
Arizona	2	1	2
California	97	94	69
Land	93	90	67
Offshore	4	4	2
Colorado	31	30	59
Florida	1	1	3
Land	0	0	2
Offshore	1	1	1
Georgia	0	0	1
Illinois	51	41	48
Indiana	10	10	10
Iowa	1	1	1
Kansas	109	103	110
Kentucky	7	5	6
Louisiana	268	279	288
North	34	44	28
S. Inland waters	109	103	120
S. Land	78	82	84
Offshore	47	50	56
Michigan	27	29	35
Mississippi	63	70	62
Missouri	2	2	1
Montana	18	20	24
Nebraska	23	23	28
Nevada	1	1	0
New Mexico	101	100	106
New York	2	2	2
North Carolina	1	1	0
North Dakota	12	10	15
Ohio	6	6	5
Oklahoma	204	210	179
Oregon	0	0	1
Pennsylvania	11	11	9
South Dakota	0	0	1
Tennessee	1	1	0
Texas	653	629	597
S. Inland waters	5	8	8
S. Land	195	171	154
Offshore	1	1	1
North	61	64	47
Panhandle	58	52	45
East	62	58	55
West Central	161	160	169
West	110	115	118
Utah	44	43	25
Washington	0	0	1
West Virginia	11	13	6
Wisconsin	1	1	0
Wyoming	58	60	74
Total U. S.	1,848	1,830	1,789
Cum. Aug. to date	1,722	1,719	1,735
Western Canada	170	160	159
Eastern Canada	0	2	0
Grand Total	2,018	1,992	1,948

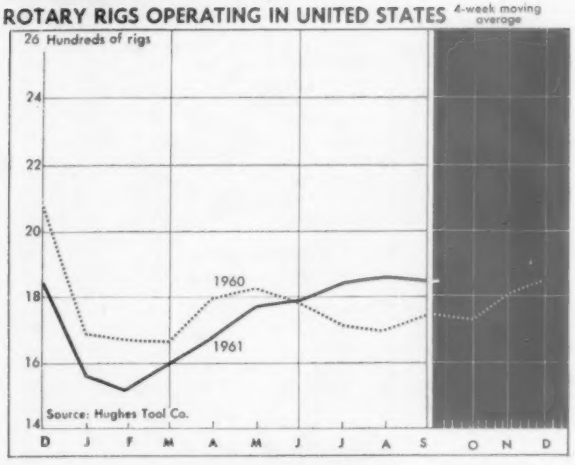
Hughes Tool Co. report.

Weekly well completions . . . Week ended October 7, 1961

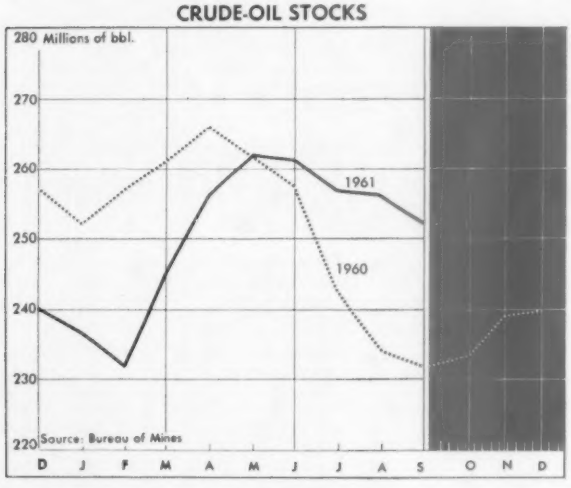
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Alabama	0	0	0	0	0	0	0	32	36	0	0	0	0	0	8	2
Alaska	1	0	0	0	1	0	2,407	33	.....	1	0	0	0	1	8	.....
Appalachian	44	17	0	14	3	10	83,418	1,635	1,411	1	0	0	1	0	56	54
Arizona	1	0	0	0	1	0	876	19	28	1	0	0	0	1	11	18
Arkansas	6	3	0	1	2	0	23,782	389	461	1	0	0	0	1	82	124
California	41	30	0	3	8	0	143,779	1,334	1,264	7	0	0	0	7	206	241
Colorado	14	0	0	4	10	0	75,835	484	488	9	0	0	0	9	225	249
Illinois	37	21	0	0	16	0	92,110	1,518	1,744	7	0	0	0	7	346	366
Indiana	14	2	0	0	11	1	23,518	564	809	7	0	0	0	7	151	298
Kansas	111	50	0	5	52	4	350,638	3,807	2,995	24	1	0	1	22	700	809
Kentucky	29	10	0	2	17	0	38,475	1,455	1,561	2	1	0	0	1	99	138
Louisiana	65	21	0	20	24	0	409,297	2,910	2,736	17	0	0	1	16	481	416
North	40	10	0	15	15	0	123,863	1,203	1,036	10	0	0	0	10	221	203
South	15	7	0	2	6	0	175,404	1,277	1,318	4	0	0	0	4	216	188
Offshore	10	4	0	3	3	0	110,030	430	382	3	0	0	1	2	44	25
Michigan	20	2	0	1	15	2	65,885	593	716	10	0	0	1	9	217	187
Mississippi	11	3	0	1	7	0	112,697	412	528	4	0	0	0	4	147	202
Montana	4	2	0	0	2	0	26,861	296	249	2	0	0	0	2	140	117
Nebraska	20	14	0	0	6	0	94,409	756	670	3	0	0	0	3	373	279
New Mexico	39	16	0	18	5	0	184,692	1,381	1,440	5	2	0	0	3	225	212
West	23	5	0	17	1	0	118,652	605	504	1	1	0	0	0	71	59
East	16	11	0	1	4	0	66,040	776	936	4	1	0	0	3	154	153
North Dakota	2	1	0	0	1	0	13,135	197	226	1	0	0	0	1	51	60
Ohio	22	8	0	2	12	0	35,243	790	821	0	0	0	0	0	34	39
Oklahoma	180	84	4	27	40	25	827,130	4,413	3,513	13	2	2	1	8	428	565
Texas	255	132	13	18	80	12	1,165,838	11,075	12,082	57	5	3	4	45	2,346	2,475
Dist. 1	25	11	0	1	13	0	68,780	699	852	11	0	0	1	10	289	319
Dist. 2	10	0	2	1	7	0	77,389	586	588	6	0	1	0	5	169	149
Dist. 3	12	5	1	1	5	0	85,622	875	914	2	0	0	0	2	171	170
Dist. 4	19	7	2	3	7	0	102,630	915	834	8	0	0	2	6	230	233
East	23	12	1	3	7	0	174,577	908	986	5	1	0	0	4	236	201
Dist. 7-B	32	15	1	1	15	0	93,505	1,395	1,756	8	2	0	0	6	388	498
West	66	49	1	1	11	4	319,999	2,758	3,148	11	2	1	0	8	556	482
Dist. 9	49	27	2	0	12	8	141,870	2,032	2,219	4	0	0	0	4	214	379
Dist. 10	19	6	3	7	3	0	101,466	907	785	2	0	1	1	0	93	44
Utah	4	0	1	1	2	0	29,281	186	181	4	0	1	1	2	85	67
Wyoming	14	5	0	2	7	0	76,738	744	794	5	0	0	0	5	280	321
Misc. (Wash.)	3	0	0	0	3	0	15,680	149	134	3	0	0	0	3	145	113
Total U. S.	937	421	18	119	325	54	3,891,724	35,172	34,887	184	11	6	10	157	6,844	7,352
Previous week	775	347	9	98	302	19	3,135,372	.....	.....	162	12	3	9	138	.....	.....
Cum. 1961	35,172	15,752	691	3,529	12,753	2,447	142,725,423	.....	.....	6,844	610	75	303	5,856	.....	.....
Cum. 1960	34,887	15,776	1,013	2,885	13,305	1,908	145,620,415	.....	.....	7,352	655	79	255	6,363	.....	.....
Western Canada	49	28	0	9	12	0	232,268	1,737	1,785	11	2	0	1	8	415	468

Production

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



Crude-oil stocks by states of origin*

(Thousands of barrels)

	9-30-61	9-23-61	10-1-60
Pennsylvania	2,319	2,288	2,356
Other Appalachian	1,458	1,456	1,328
Illinois, Indiana, Michigan	10,170	10,257	8,756
Nebraska and North Dakota	3,206	3,392	2,710
Kansas	8,665	8,782	8,321
Oklahoma	16,231	16,672	15,116
Arkansas	1,555	1,540	1,819
Louisiana	20,340	19,589	18,424
North	3,385	3,412	2,981
South	16,955	16,177	15,443
Mississippi, Alabama, Florida	3,637	3,667	1,762
New Mexico	9,190	9,164	8,426
Texas	108,862	107,470	97,554
East Texas	8,346	7,880	7,434
West Texas	48,765	48,676	47,913
Texas Gulf	19,740	19,396	16,488
Other Texas	32,011	31,518	25,719
Wyoming	16,483	16,912	15,602
Other Rocky Mountain	10,073	10,052	8,942
California	23,696	23,828	26,630
Foreign	†16,097	15,651	14,127
Total	**251,982**	250,720	231,873

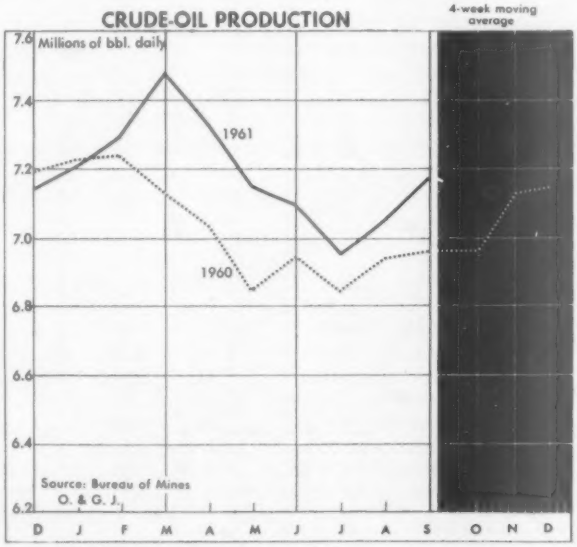
*Bureau of Mines. †Includes 5,108,000 bbl. in California.

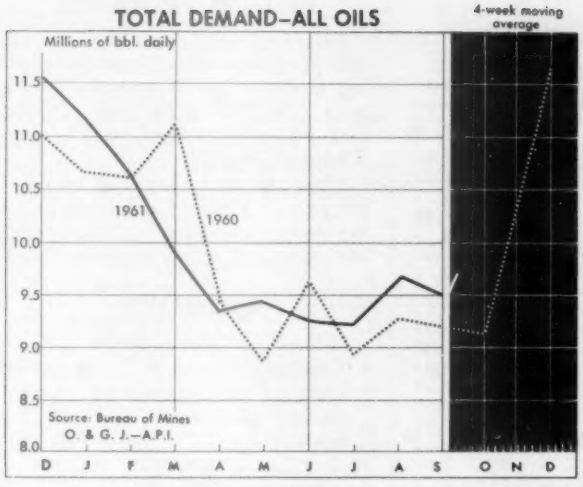
Daily average production for week

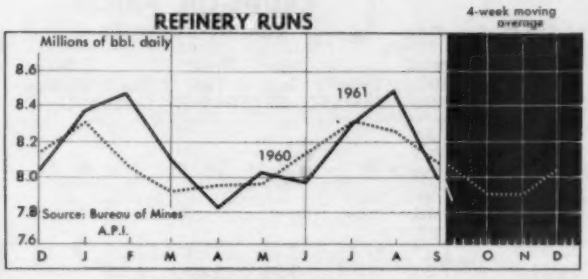
	October 7, 1961 Crude oil	Lease condensate	Total	Sept. 30 total
Alabama	16,800		16,800	16,900
Alaska	22,000		22,000	21,800
Arkansas	73,300	125	73,425	73,400
California	813,400		813,400	812,000
Colorado	127,300		127,300	126,000
Eastern	41,800		41,800	40,900
Florida	900		900	1,000
Illinois	215,500		215,500	218,400
Indiana	30,400		30,400	30,100
Kansas	†310,600		†310,600	†307,825
Kentucky	51,600		51,600	51,200
Louisiana	1,028,000	158,125	1,186,125	1,164,025
North	103,450	5,850	109,300	110,300
South	924,550	152,275	1,076,825	1,053,725
Michigan	52,500		52,500	52,800
Mississippi	146,000	4,100	150,100	150,000
Montana	87,800		87,800	88,500
Nebraska	72,500		72,500	71,900
Nevada	400		400	400
New Mexico	308,000	7,500	315,500	308,000
North Dakota	60,900		60,900	60,700
Oklahoma	†494,800		†494,800	†525,500
Texas	2,405,000	92,000	2,497,000	2,580,400
Dist. 1	43,000	2,800	45,800	45,700
Dist. 2	103,000	8,000	111,000	113,000
Dist. 3	305,000	38,000	343,000	365,000
Dist. 4	176,000	13,500	189,500	194,000
Dist. 5	26,000	700	26,700	27,650
Dist. 6	115,000	8,500	123,500	125,000
East Texas field	126,000		126,000	129,000
Dist. 7-B	125,000	450	125,450	129,400
Dist. 7-C	106,000	3,550	109,550	112,450
Dist. 8	980,000	12,000	992,000	1,034,000
Dist. 9	194,000	2,500	196,500	196,500
Dist. 10	106,000	2,000	108,000	108,700
Utah	92,400		92,400	91,100
Wyoming	408,700		408,700	403,600
Others	‡600		‡600	‡700
Total U. S.	6,861,200	261,850	**7,123,050**	7,197,150
Change from prev. week, down			**74,100**	
Canada	†577,000	†17,000	†594,000	†684,500
Total U. S. Prod.—Jan. 1-Oct. 7			2,013,111,600 bbl.	
Same period last year (crude plus cond.)			*1,972,272,800 bbl.	

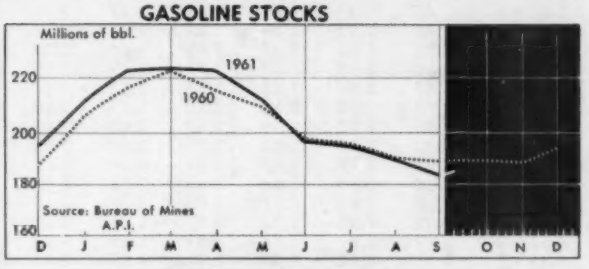
*Includes 63,395,100 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona.

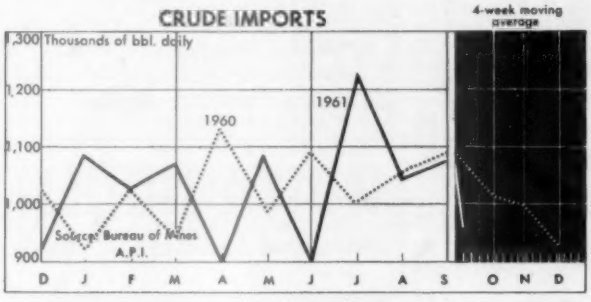
CRUDE-OIL PRODUCTION

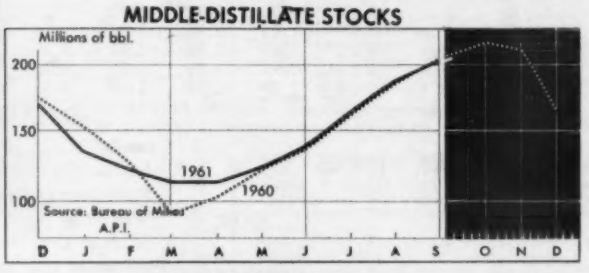


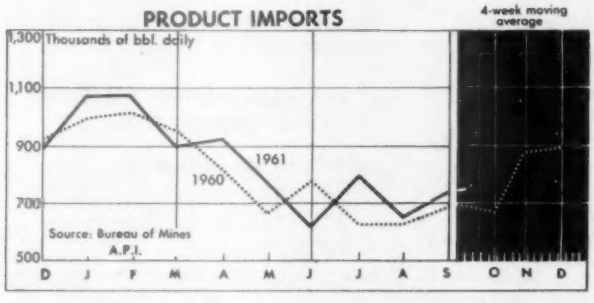


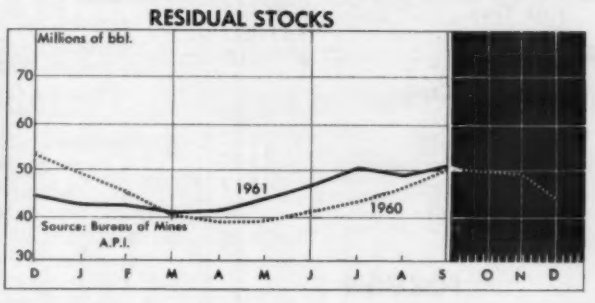












API refinery report—October 6, 1961

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, October 1960—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,122	537.3	31.1	363.9	164.7	45,102	14,531	64,030	14,572	1,159	517.7	36.6	341.5	143.9
Appalachian:														
District 1	103	48.7	4.0	23.0	7.0	5,714	740	3,988	375	75	30.7	2.1	15.5	9.3
District 2	108	60.9	5.9	19.1	11.1	2,935	478	1,659	247	108	56.5	5.7	21.1	11.3
Ind., Ill., Ky.	1,492	756.4	65.1	320.4	134.6	31,527	7,466	30,670	5,705	1,420	725.4	77.9	311.4	156.6
Minn., Wis., Dak.	122	58.9	4.3	30.0	13.7	6,754	1,750	8,249	635	118	55.4	4.7	29.2	16.7
Okla., Kans., Mo.	700	402.9	11.9	187.0	15.9	17,685	1,792	12,882	1,063	674	375.2	8.8	169.4	20.0
Inland Texas	280	212.9	15.4	39.7	19.0	7,053	694	1,571	2,702	276	218.8	9.2	44.0	18.9
Texas Gulf Coast	1,870	932.4	102.2	483.2	112.1	21,149	3,181	16,010	5,090	1,864	972.9	124.1	473.3	128.3
La. Gulf Coast	695	331.4	67.3	161.7	41.0	10,108	2,233	6,365	1,281	674	340.5	76.0	135.6	47.2
N. La. and Ark.	117	68.7	5.7	23.4	6.3	6,328	678	2,765	197	110	66.6	6.1	21.7	5.6
Rocky Mountain:														
New Mexico	27	16.4	0.6	2.6	2.7	639	45	228	68	14	9.8	0.3	2.5	2.2
Other Rocky Mt.	303	130.3	8.7	58.7	32.0	5,290	695	2,857	1,166	284	136.8	2.9	65.4	29.2
West Coast	1,216	556.1	61.1	174.3	228.9	24,826	1,982	15,164	16,979	1,132	527.1	32.5	184.3	241.7
Oct. 6, 1961	8,155	4,113.3	383.3	1,887.0	789.0	185,110	36,265	166,438	50,080	7,908	4,033.4	386.9	1,814.9	830.9
Sept. 29, 1961	§8,101	§4,265.4	§413.6	§1,894.9	§836.3	184,484	35,790	166,139	50,220	.....	.....	.....	.....	.....
Oct. 7, 1960	7,880	3,961.9	324.0	1,694.0	847.1	188,642	35,121	171,437	50,766	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Rev.

Prices

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	....	....	....	....	....	*	2.01
20-20.9	2.27	$2.49	†$2.35	$2.61	$2.29	$2.95	$2.90	‡$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague. †Other posting starts at $2.55. ‡Some at $2.38.

FLAT PRICES

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.10-3.25
- Conroe 3.23-3.53
- ★ Van 2.93-3.08

Pennsylvania Grade:
- Bradford $4.80
- Middle District 4.52
- Southwest Pennsylvania 4.25
- West Virginia 4.17
- Buckeye Grade 4.08

Illinois Basin 3.00-3.05

FOREIGN

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)
- Arabian, 34.0°-34.9°, Ras Tanura $1.80
- Iranian, 34.0°-34.9°, Bandar Mashur 1.78
- Iranian, 34.0°-34.9°, Abadan 1.73
- Iraq, 35.0°-35.9°, Fao
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.59
- Qatar, 41°-41.9°, Umm said 1.95

Middle East, E. Mediterranean:
- Arabian, 34.0°-34.9°, Sidon $2.17
- Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.19

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 36° 2.42

Canada:
- Leduc-Woodbend $2.63
- Redwater (Alta.) 2.52
- Weyburn (light) 2.185
- Midale C 1.89

Venezuela:
- Cumarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Price for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

TANKER RATES (Long ton)

(Latest reported spot fixtures)
- ★ Gulf-NY, clean (ATRS—22.5%) $2.21
- ★ Gulf-NY, dirty (ATRS—5%) 2.71
- ★ Carib.-NY, dirty (ATRS—45%) 1.51
- ★ PG-NY, dirty (USMC—65%) 4.45
- PG-Japan, dirty (USMC—70%) 3.06

★ Denotes change from previous week.

REFINED PRODUCTS

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):
- ★ Regular (91 octane) 9.50-10.00
- ★ Premium (99 octane) 12.25-12.75
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) 10.50-11.00
- Regular (92 octane) 10.75-11.25

California (rack) Los Angeles:
- ★ Regular (90 octane) 11.20
- ★ Premium (94 octane) 12.20
- ★ Premium (100 octane) 13.35

Caribbean area (cargoes):
- Regular (87 octane) 9.00
- Premium (97 octane) 11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):
- Kerosine 42-44 ..... 9.50-9.75
- Diesel oil (58 d.i. and above) 9.00-9.25
- Distillate No. 1 ..... 9.00-9.25
- Distillate No. 2 ..... 8.25-8.50

Gulf Coast (cargoes):
- Kerosine 41-43 ..... 9.50
- Distillate No. 2 ..... 8.50

New York Harbor (barges):
- Kerosine 42-43 ..... 11.20
- Distillate No. 2 ..... 10.20
- Diesel fuel, 48-52 d.i. 10.35

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.10

RESIDUAL FUEL

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.65-1.75

Gulf Coast (cargoes):
- Bunker C fuel 2.20-2.30

New York Harbor (barges):
- Bunker C fuel 2.52

Caribbean (cargoes):
- Bunker C fuel 2.00

California (rack):
- Bunker C fuel, Los Angeles 2.25

CLASSIFIED ADVERTISING

. . . your market place for the oil and gas industry

RATES:

- UNDISPLAYED CLASSIFIED: 30c a word per issue. 10% discount for three or more consecutive issues. $5.00 minimum charge. Blind box in our care count nine extra words. Not subject agency commission.
- DISPLAYED CLASSIFIED $20 a column inch one issue. 10% discount three or more consecutive issues. Minimum size one inch. Subject to agency commission.
- All classified payable in advance.

- DEADLINE: Copy to reach The Oil and Gas Journal not later than 9a.m. on Wednesday preceding date of publication. Send advertisments to: Classified Advertising Manager, THE OIL AND GAS JOURNAL, P. O. Box 1260, Tulsa 1, Oklahoma.

EXCEPT . . .

WESTERN STATES: (California, Washington, Oregon, Idaho, Nevada, Utah, and Arizona). Write: Classified Departments, Inc., The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif. Phone AXminister 2-0287. Copy deadline Monday noon.

FOR SALE EQUIPMENT

AN INVESTMENT! Productive advertising is an investment rather than an expenditure. Experienced oil men have found that The Oil and Gas Journal is their best classified advertising medium.

USED GAS PROCESSING Equipment: Glycol and Dry Dessicant Dehydrators; Quick-cycle Hydrocarbon Recovery Units; Water Flood Filter-pump Units. Also new oil and gas production equipment. Engineered Specialties Co., P. O. Box 35683, Phone FL 1-5284, Dallas 35, Texas.

MISSION HAMMER Drills and Bits ½ Price. Guaranteed like new. Drilled only two shallow wells (1,000 feet). 1 Size 3⅞" O.D. Hammerdrill; 2 Size 4½" to 4¾" Hammerbits; 1 Size 5¼" O.D. Hammerdrill; 1 Size 6¼" O.D. Hammerbit. Also 1 Leroy 100s2 Air Compressor Piston Type 125 psi and 455 CFM. Worthington Boiler Feed Pump and Dust Deflector. Brunson-Spines, 302 Union Center. Wichita 2, Kansas.

LIQUIDATION

at ESSO REFINERY Balto., Md.

MOST EQUIPMENT NEW 1956

TOWERS—30" to 84" diameter, 20' to 97' high, 7 to 34 trays, up to 360 PSI

DRUMS—3' to 12' diameter, 12' to 45' long to 530 PSI, some lined—some NEW

PETRO-CHEM FURNACES—30.7; 19.3; 10.4; 9.7; 7.5 MM BTU/Hr.

NEW FURNACE TUBES—4000'—⅜" & ½" Wall Croloy 5—4" to 6"

PUMPS—88 to 400 GPM up to 2040' head—up to 8 Stage

HEAT EXCHANGERS—CONDENSERS

Stainless Tubes	—235 to 2320 Sq. Ft.
Croloy 5 Tubes	—573 to 1040 Sq. Ft.
Admiralty Tubes	—216 to 1640 Sq. Ft.
Steel Tubes	—238 to 2240 Sq. Ft.

COMPRESSORS & BLOWERS

7500CFM @ 42.5PSIG, 1250HP Synch.

129CFM @ 193PSIA Worth. HB 7½x9

LARGE QUANTITY TRANSFORMERS & MOTORS

WRITE FOR CATALOG

HEAT & POWER CO. INC.

60 East 42nd St., New York 17, N. Y.
310 Thompson Bldg., Tulsa, Okla.
Boston & Haven St., Baltimore 24, Md.

FOR SALE EQUIPMENT

THREE SURFACE Combustion Corp., Special GFH-DX combustion generating units, 16,330 CFH, capacity, natural gas 2040 cu. ft./hour, air 20400 pressure 24-oz. with accessories. Alfred B. Kern, 305 Kennedy Bldg., Tulsa, Oklahoma.

FAILING 2500, 58' mast, 5 x 8 Pump. Howard Turner, Trailer Mounted. 1500 Failing. Fred Butler, Box 481, Pueblo, Colorado.

50,000 FT. 20 inch No. 1 grade used pipe. Lengths 20 ft. square cut ends. Weight 78# to the ft. High Tensile Pipe. Indiana-Ohio Pipe Co., P. O. Box 5462 Shep. Sta., Columbus 19, Ohio. Phone CL 3-5527—CL 3-5528.

SELL OR trade for production, surplus equipment, anything of equal value. 4,000' Rotary, diesel powered, 7¼ x 14 pump, all miscellaneous equipment complete, ready for drilling. $25,000 cash or will finance. Milford Giffin, 580W, Chelsa, Oklahoma.

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LIQUIDATION
Little Rock, Arkansas

11—28,000 gal. horiz. tanks, 11' x 38', dished, ASME 75 psi.

3—Worthington #LTC-4 air comp., 3,500 CFM, 24 x 15, 500 HP, nat. gas driven.

50—Heat exchangers, T316 Stainless, up to 2,000 sq. ft.

PERRY EQUIPMENT CORPORATION
1402 NORTH SIXTH STREET
Philadelphia 22, Pa., Phone POplar 3-3505

FOR SALE EQUIPMENT

BOILER—Bigelow, Scotch, Oil Fired-350 lb. pressure, 850 Ft. Heating Surface. New 1951. P. A. Henault 26799 W. 8 Mile Rd, Detroit 40, Mich.

FOR SALE

Acidizing—fracturing—surplus equipment. Write Texas Transport Equipment Corp., Attention Clark Core, P. O. Box 47, Phone FR 9-5132, Seguin, Texas. Terms: cash—rent—lease-purchase to qualifying buyers. Equipment priced at 25 to 50% of acquisition cost.

Pump Trucks, Mack and International with triplex HP acid pumps sizes 3¾ x 5, 5 x 5, 4 x 8, 4½ x 8, includes tanks and HP connections.

Sand Proportioners, 4-wheel and float tandem, capacity 15-25 bbls. w/sand carrying and tank capacity.

Sand Transport, one Fruehauf 400 cwt tandem float.

Flush Tanks, 265 bbl. skid mounted.

Cameron Valves, HP 1000#, 3000-6000# pressure.

Sand Storage, 2—300,000# w/elevator & scales.

Paddle 4-Wheel Trailers, w/2000 gal. heavy tanks, Wisconsin power and Fairbanks-Morse centrifugal pumps and connections.

Radio 2-way, General Electric industrial system w/200' tower and 6 car sets.

Motors, Hall Scott marine, 650 HP, uses gas or gasoline.

USED EXPLORATORY RIG, COMPLETE!

GA-500-EMSCO 6,000 ft. plus capacity; Moore 126' mast, 9' substructure; 16" G-D pump; 2-LRT-6-1 Cummins Diesels; approx. 5,000 ft. 4½" drill string.

A MOST COMPLETE exploratory rig. All accessories, many extras; winterized; no additions needed, start drilling.

LOCATION: Near Craig, Colo.

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SWEENY, TEXAS, GASOLINE PLANT

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4—4' x 62'	2250#	Absorbers
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VESSELS

1—5' x 22'	2000#	Separator
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1—12' x 26'	200#	Drums

Other small high pressure drums

ATMOSPHERIC EXCHANGERS

9—293	sq. ft.	2500#	WP
12—324	sq. ft.	2500#	WP
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12—1,690	sq. ft.	steel	400#	WP
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1—Carrier Refrigeration Compressor MODEL 18P301 400 hp., coolers and condensers Approximately, 50 process pumps up to 1540 GPM and 3,700 ft. head. A large selection of gate, check and plug valves

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SERVICE TRUCKS; Testing, temperature and pressure. Phone DA 1-2899, El Dorado, Kansas.

1—C-34 Walker-Neer, trailer-mounted, 87' mast; 1—RL Cardwell 3-drum; 1—RL Cardwell, 2-drum; completely equipped; working in Oklahoma Panhandle; inventory and price on request. Box M-583, The Oil and Gas Journal, Tulsa, Oklahoma.

1—COOPER MODEL W Double Drum Unit Mounted on 1955 F-8 Ford. 1—Cooper Model W Single Drum Unit Mounted on 1954 Chevrolet. 1—Bucyrus Erie 22-W Spudder Mounted on 1955 Chevrolet. All rigs in first class condition. Financing can be arranged to a responsible person. Kent Well Servicing Company, Inc., Drawer 470, El Dorado, Kansas, Phone DA 1-9440

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127' LEE C. MOORE MAST 7' Substructure, U-15 Drawworks, 2 Engine Compound, 13-6" Drill Collars, Pipe Racks, 200 Bbl. Water Tank Skidded, 7¼ x 14 Pump, Set of Type "C" Tongs, 4½ Elevators, 3 and 4 Shieve Traveling Blocks, 3-10 KW Light Plants 906 S.E. 29th, Oklahoma City, Okla. OR 7-4541.

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PECO GAS FILTER, Series 70, 5' x 10" horizontal vessel, .365" thick. Manufactured 1958. Like new, $500.

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5" x 11" INGERSOL-RAND ES-1 COMPRESSOR CYLINDER

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DELONG AIRJACKS for raising drilling platforms or drydocks. 72" I.D. New surplus condition, complete. 40 available. Our price $2,500.00 each. New cost $25,000.00 each. Phone—NE 3-8027, Marine Equipment Corporation, 3060 N. W. North River Drive, Miami, Florida.

2500 TRAILER MOUNTED Franks. Powered with 671 and 471 G.M. Diesels, 7x10 Wheatly pump, water pump, 1000' water line, approximately 3000', 3" or 4" drill pipe. Two Chevrolet trucks, ton and half, 300 electric welder, miscellaneous drilling tools complete with doghouse. All excellent condition. $14,500. Also, 2500 Franks Friction Clutch Drawworks, completely overhauled. $750.00. Milford Griffin, 580W, Chelsa, Oklahoma.

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WANTED: 12 volt acoustic well sounder or echometer, must be in workable condition. Would consider good 6 volt unit. Homestake Production Company, 2300 Philtower Building, Tulsa, Oklahoma.

WANTED, USED, simultaneous Gamma Ray—Neutron Logging Equipment. Preferably W.S.I., including Dual Pen Brown Recorder. Must be in A-1 condition. Box M-589, The Oil and Gas Journal, Tulsa, Oklahoma.

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SENIOR PROCESS ENGINEER

Experience required in designing all types of refinery process units. Splendid opportunity to advance with engineering and construction firm having world-wide representation. All replies held in strict confidence. Address or call collect:

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If you would like to join an expanding organization that offers growth potentials limited only to individual ability, we now have opening for Chemical and Mechanical Engineers with BS degree and two to four years technical or production experience as Technical Assistant to our Production Department Heads.

Our modern plant is located in Memphis, Tenn. which offers a moderate climate and moderate living costs. Attractive housing available. All replies held in strictest confidence.

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Industrial Relations Department

W. R. GRACE & CO.
NITROGEN PRODUCTS DIVISION
P. O. BOX 4915
MEMPHIS, TENN.

HELP WANTED

WANTED, BY new company. Experienced gas processing engineer, North Louisiana. Write, giving full experience, references, and present employment status to: Box M-582, The Oil and Gas Journal, Tulsa, Oklahoma.

TRANSLATORS-ENGINEERS WANTED—Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian & Japanese. Send resume to: A•T•S, Inc., Drawer 271, East Orange, N. J.

WANTED, by progressive independent producing company—Graduate Petroleum Engineer with a minimum of 8 years experience in drilling programs, well completions and workover recommendations. Furnish full history of experience. All replies will be treated confidentially. Box M-599, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL JOB DIRECTORY, foreign and domestic, showing where to apply for jobs $5.00 cash OIML Co., Box 2603, Tulsa, Oklahoma.

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For International Engineering Construction Firm

Applicants should have minimum of 5 years direct labor experience in refinery & chemical plant construction Send resume to Box OGJ 1413 125 W 41 St. New York 36, N. Y.

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Desired for opportunities in a large modern refinery of the Lago Oil & Transport Company, Ltd., in Aruba, Netherlands Antilles, en afiliate of STANDARD OIL COMPANY (N.J.). Candidates must be graduate Chemical Engineers with 3 to 5 years refinery experience and a working knowledge of refinery processes for performance analysis, design and economic evaluation of the operation of a major refinery. Possibilities for later assignment to Economics and Programming Group. Liberal employee benefits including home vacations with travel allowances. Interviews will be arranged for qualified candidates. All replies confidential. Send complete resume of work experience and personal data to:

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Department E
Radio City Station
New York 19, New York

SITUATIONS WANTED

PETROLEUM ENGINEER desires position as production manager or chief engineer with aggressive independent operator specializing in secondary recovery operations. Ten years diversified experience in evaluation, development, operation of secondary recovery operations. Presently responsibly employed. Box M-588, The Oil and Gas Journal, Tulsa, Okla.

ACCOUNTANT & OFFICE Manager—Thirteen years drilling and production. Prior four years public accounting. Available to locate midcontinent area. Complete profile on request. A. R. Derrington, 726 South Glenn, Wichita, Kansas.

PETROLEUM ENGINEER—36, married. Twelve years diversified experience including management, financial and policy. Prefer southwest. Top references and resume on request. Box M-596, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

GEOPHYSICIST, presently located in South America, 8 years interpretation, administration, wants position with medium-sized company, preferably in Europe (Lybia) or Australia. Box M-602, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED landman with references will lease anywhere by the day, week, month or acre. Write box 439, Mount Carmel, Illinois.

PALEONTOLOGIST, 44 single, desires overseas position with oil company. 18 years experience with Tertiary and Cretaceous Foraminifera, and ammonites, in California, Colombia and Libya. Some field and wellsite work. Knows Spanish, learning Arabic. Box M-465, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER, thirteen years diversified experience drilling, production, equipment, and reservoir, foreign and domestic. Age 37. BSME degree. Desires responsible position foreign or domestic. Box M-597, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

LOCAL LEASEMAN wants party interested in purchasing small and scattered $1. per acre leases in counties of Furnas, Harlan, Phelps and Gosper, Nebraska. Box M-600, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE OR Sublease: 200 acres Government lease; five years to go, (1962—1967). Located in San Juan County, Utah. Township 39 S. Addresse inquiries to: Joseph Heupel, P. O. Box 35, Colts Neck, N. J.

BARTLESVILLE & PERU production on three sides of new well to start 4/8ths working interest for sale for $800.00 per 1/8th reply box 589, Independence, Kans.

NEED partners to help drill Arbuckle test (under 2,000') on 480 acres in semi-proven area, Montgomery County, Kansas. Box M-586, The Oil and Gas Journal, Tulsa, Oklahoma.

ST. LOUIS GROUP with substantial production interested in purchasing primary and secondary oil reserves in Illinois, Indiana, Kentucky or West Virginia. Can handle properties of any size. All replies confidential and all material forwarded will be returned. Box M-575, The Oil and Gas Journal, Tulsa, Oklahoma.

FINANCIAL—Investment Banking Houses and Underwriters reached. Confidential You can send the details of your proposition direct or thru your attorney to Consultant 817—51st Street, Brooklyn, N. Y.

OIL FIELD engine repair and supply business doing over $100,000 yearly in Kansas. A real buy. Box M-585, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION PROSPECTS WANTED

Individual desires up to 25% interest in prospects being drilled before December 15th. Submit only ventures based on sound geology. Prefer extensive acreage and large potential per well. Deal and offeror must stand rigid inspection. Reply to:

EDMUND OIL & GAS
Attention G. R. Stocker, Geologist
P. O. Box 99, Barrington, New Jersey
Telephone: Area Code 609, LIncoln 7-3230

REAL ESTATE

SMALL CHICKEN Ranch in Ozark Lake Country. For Sale at Bargain. Call or write E. A. Morse, Lincoln, Ark. Ph. TA 4-2531.

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PRODUCTION WANTED

Large oil producing wells with acreage wanted. Must have complete information and stand strict checking. Unlimited funds available. Box M-601, The Oil and Gas Journal, Tulsa, Oklahoma.

ROYALTIES

ROYALTY BUYERS—Income producing gas-distillate royalty, new, deep, dual completed wells, Texas Gulf Coast. Tax benefits being 27½% of depletion allowance. Ogden Oil Company, P. O. Box 409, Taylor, Texas.

LEASE AND DRILLING BLOCKS

ARIZONA—Big "Helium" lease play. Leases Available near Majors $1.00 acre. Terms—Free Maps. Edward Colson, 1716 W. Devonshire, Phoenix, Arizona.

OIL AND GAS RIGHTS, good spread, low cost due to unusual situation P. O. Box 503, Limon, Colorado.

FOR SALE Half interest in 12,000 Acres in Harper County Township 25N 23W. Full interest in N½ Sec. 1-24N-23W in Ellis County, and W½ NW Sec. 6-24N-22W in Woodward County. $10.000 per Acre ⅛th override, or $25.00 per Acre straight. Bob McClung, May, Okla. Phone May 30.

DO YOU HAVE A LEASE TO SELL? For as little as $5 per week you can tell your proposition to over 45,000 oil men through the Journal's classified advertising pages You'll be surprised how many are interested

ARIZONA HELIUM, state land, 5 year leases only 25 cents an acre annual rent. In Apache County where Kerr-McGee plant is now building. Free Information. John L Donahue, 430 16th Street, Denver 2, Colorado. rado.

DRILLING REPORT: Two wells going to Bartlesville Sand offsetting production. Mail card or letter for full information. MURCO Production Co., Box 59, Cherryvale, Kansas Phones 740 or 241.

COMPANY reorganizing drilling program Offers block of 4 leases, 150 A, 410 A, 480 A, 320 A, in 13, 23, 24, 33S, R 13E, Montgomery County, Kansas. Titles examined and O.K. One or all at $5.00 per acre. Western Plains Oil & Gas Co., 1035 Petroleum Club Bldg., Denver, Colo.

OIL AND GAS leases in active area of Nebraska. Detailed information write: Box M-568, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Up to ½ interest 40 acres offsetting new water flood. One well pumping, good investment for nice income, more good locations to drill. Montgomery County, Kansas. Bartlesville production 730 feet. Box M-593, The Oil and Gas Journal, Tulsa, Oklahoma.

HAVE LEASES IN N. & N. E. Ohio. 1 Block 3500 Acres, Clinton Production Assured, deeper production possible. Write: W. P. Hambleton, Box 522, Hartville, Ohio.

LIST OF 100 oil companies showing names of land-leasing managers and division land managers. $5.00 cash. Oil Industry Mailing List, 405 Tuloma Bldg., Tulsa, Okla.

OIL AND GAS PROPERTIES

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Located—near Burkburnett, Texas

Socony Mobil Oil Company, Inc. considering sale of above properties consisting of: 3456 unitized acres, 38 producing oil wells, 2 WSW, 48 WIW, 179 wells NIO. Basic equipment: 11 tank batteries. 21 electrified beam pumping units, 23 Reda pumps, Injection station, electrical and water distribution systems. Sale by bid on November 1, 1961. Not an offer to sell. Reserve right to reject any or all bids.

Complete Information Available on Request

SOCONY MOBIL OIL COMPANY, INC.

P. O. Box 239 Phone 723-1436
Wichita Falls, Texas

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If you need assistance in obtaining outstanding interests in oil and gas leases owned by individuals residing Southern California, we would like to offer our services.

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The Oil and Gas Journal

Box 1260 Tulsa, Okla.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Indian Affairs, Uintah and Ouray Agency, Fort Duchesne, Utah. Sealed bids will be received until 2:00 P.M. Mountain Standard Time, November 1, 1961, and opened at that time in the office of the Superintendent, Uintah and Ouray Agency, Fort Duchesne, for the leasing of 1,298.54 acres of allotted Indian lands, in Townships 12 and 13 South, Ranges 19, 20 and 21 East, Salt Lake meridian, Uintah County, Utah, for oil and gas mining purposes. Details of the lease opening and how and where to file bids may be obtained by addressing an inquiry to the Superintendent, Uintah and Ouray Indian Agency, Fort Duchesne, Utah.

Discoveries

(Continued from Page 167)

KANSAS

Clark County:

Sinclair Oil & Gas Co. 1 C. H. Tuttle, C NW SE 8-35s-21w. IPF 8,500 M.c.f.d., with trace cond., ¾-in. choke, TP 600 psi., CP 1,300 psi., Morrow 5,590-5,606 ft. TD 7,601 ft. New gas discovery.

Ellis County:

Don E. Pratt et al. 2 Keller "E", SE SE NW 23-14s-20w. IPP 32 BOPD, no water, 32°, Lansing-Kansas City 3,449-53 ft. TD 3,773 ft. PB 3,650 ft. New oil discovery.

Haskell County:

Pan American Petroleum Corp. 1 Black Gas Unit "C", C SW NE 17-30s-33w. IPF 150 BOPD, 35°, Lansing 4,420-22 ft.; IPF 1,630 M.c.f.d., SIP 1250 psi., Des Moines 4,990-95 ft.; IPOF 1,280 M.c.f.d., SIP 1,200 psi., Morrow 5,270-5,318 ft. TD 6,100 ft. New oil and gas discovery, triple completion.

Stevens County:

Mobil Oil Co. 1 Anderson Trust unit, C SW NE 27-31s-35w. IPF BOPD, 14/64-in. choke, TP 420 psi., CP 1,150 psi., 18 M.c.f.d., GIR 332:1, 41.5°, Chester Miss. 6,003-16 ft. TD 6,285 ft. New oil discovery.

Pan American Petroleum Corp. 1 Hahn gas unit "C," SE NW 6-31s-38w. IP 975 M.c.f.d., SIP 840/48 hours, Morrow 5,655-57 ft. TD 5,900 ft. PB 5,758 ft. New gas discovery.

KENTUCKY

Christian County:

Ryan Oil Co. 3 Pennyrile State Park, 16-H-23. IP 1,118 M.c.f.d., shut in gas well. TD 1,493 ft.

Daviess County:

Dr. Lee Tyler et al. 1 Bernadine Shadler, 6-0-27. IP 90 BOPD, O'Hara 2,094-2,103 ft. TD 2,205 ft. Opens North Curdsville field.

NORTH LOUISIANA

Catahoula Parish:

Crow-Greyhound Drilling Co., Inc., et al. 1 Gillis, C E½ NE NW 15-8n-7e. IP 60 BOPD, 6/64-in., 41.8°, TP 360 psi., GOR 200 cu. ft. per bbl., perf. 4,566½-68 ft., Wilcox-Tew Lake sand. TD 4,665 ft. Reopens abandoned Pool Lake field.

Sabine Parish:

Mobley & Stephens 1 J. H. Cain, 15-7n-10w. IPP 30 BOPD, 42°, perf. 3,017-84 ft., Sara sand. TD 3,560 ft. Extends Zwolle field 2¼ miles southeast.

SOUTH LOUISIANA

Calcasieu Parish:

M. P. S. Production Co. et al. 1-A Sweet Lake Land & Oil Co., 4-11s-6w, 1½ miles southwest of East Bell City field and 1½ miles northwest of South Bell City field. IP 84 BOPD and 3 M.M.c.f.d., 13/64-in., 54.8°, TP 3,400 psi., perf. 10,407-11 ft. TD 11,145 ft. New-field discovery.

MICHIGAN

Allegan County:

Worth Exploration Co. 1 Dubas, C SW SW 5-1n-15w, Lee Township, FAIP 4,800 M.c.f.d. Elev. 640kb, A-2 Salina 1,600, TD 2,468. Perf. 1,645-52. Deeper pay in East Pullman oil pool.

Lenawee County:

Good and Good Drilling Co. 1 Beal, NE NW SW 3-8s-1e, Medina Township, 15 miles southeast Adams pool. AIP 22 BOPD. Elevation 853rf, Trenton 2,805, pay 2,892-2,905, 2,921-3,476, TD 3,476. New oil pool.

Osceola County:

Benedum-Trees and Atha 1 Pattee, NE NE SW 28-17n-7w, Orient Township, AIP 12 BOD. TD 3,867 ft. El 1,092, Dundee 3,864, pay 3,865-68. New pay in North Fork pool.

MISSISSIPPI

Amite County:

J. E. Thornhill et al. 1 Carter, NE SE SE 1-2n-6e. IPP 26 BOPD, 13% b.s. and w., 38°, perf. 11,182-92 ft., Tuscaloosa. TD 11,256 ft. New-field discovery (former dry hole sidetracked and redrilled—OTD 11,420 ft.).

NEBRASKA

Cheyenne County:

Texota Oil Co. 1 Madden, OWWO OTD 5,700 ft., NW NE 24-13n-53w. IPP 147 BOPD, "J" sand 5,639-43 ft. TD 5,700 ft. "J" sand discovery, new pay.

Frontier County:

Blair & Associates-Murfin Drilling Co. 1 Zimmer, C NW SW 33-6n-30w. IPP 12 BO, 12 BWPD, Basal sand discovery, new Pennsylvanian field. TD 4,260 ft. 4,230-40 ft.

Kimball County, Sloss area:

Enbrook Oil & Gas Co. et al. 1 Skryja, C SE NW 20-14n-55w. IPP 113 BOPD and some b.s. and w. "D" sand 6,242-46 ft. TD 6,458 ft. "D" sand discovery, new field.

Wyoming Western Oil Co. et al. 1 Voss, SW SE 20-14n-57w. IPP 285 BOPD, "J" sand discovery, new field. TD 6,997 ft. "J" sand 6,985-97 ft.

Sterling Drilling Co. 1 Dunn, C SE NE 31-3n-36w. IPP 95 BOPD, cut 4% water, Foraker 3,824-63 ft. TD 5,212 ft. Foraker Permian discovery, new field.

NEW MEXICO

Eddy County:

Gulf Oil Corp. 1-BO Littlefield, 2 miles east of Corrall in 34-26s-29e. IPF 22 BOPD, 88 BWPD, 22/64-in. choke, 38.3°, GOR 13,858:1, TP 225 psi., CP 475 psi., Delaware 2,957 ft. TD 2,970 ft. New oil discovery.

Jack L. McClellan 1 Simmons, 15 miles northwest of Maljamar in 24-16s-29e. IPF 45 BOPD, 16/64-in. choke, TP 100 psi., CP 300 psi., open hole. New oil discovery. Top pay 2,658 ft.

Lea County:

Carper Drilling Co., Inc., 2-B Carper Cockburn-State, 1-18s-33e. IPF 100 BOPD, ¾-in. choke, 37°, TP 250 psi., CP 100 psi., lower Queen sand 4,136-60 ft. TD 12,910 ft. PB 4,375 ft. New oil discovery.

Texaco Inc. 1-B G. L. Erwin, NCT-2, 19 miles southeast of Eunice in 35-24s-37e. IPF 157 BOPD, 18/64-in. choke, 46.5° gravity, GOR 976:1, TP 125 psi., CP packer, Ellenburger 8,458-82 ft.; IPF 222 BOPD, 12/64-in. choke, 46.5, GOR 1,388:1, TP 300 psi., CP packer, McKee 7,928-8,014 ft.; IPF 239 BOPD, 14/64-ni. choke, 37.5°, GOR 741:1, TP 400 psi., CP 500 psi., Drinkard 5,958-6,040 ft. TD 8,565 ft. Triple-zone oil discovery.

Rio Arriba County:

Lemm & Maiatico 1 Arellano, SE NW 5-24n-1e. IPP 77 BOPD, Lower Mancos discovery, new field. Lower Mancos 4,363-4,416 ft. TD 4,416 ft.

San Juan County:

Amalgamated Petroleum Co. 3 Navajo, C SE SW 24-32n-18w. IPP 49 BOPD, 40.3°, Gallup 1,110-26 ft. TD 1,163 ft. Gallup discovery, new field.

NORTH DAKOTA

Williams County, McGregor:

Dallea Petroleum Co. 1 Hamlet unit, S½ SW 30-159n-95w. IPF 439 BOPD, plus 5% water, 16/64-in. choke, 41.3°, GOR 894:1, Duperow 10,188-10,247 ft. TD 10,300 ft. Devonian discovery, new field.

OHIO

Lawrence County:

Harvey Star 1 Frank Herrell, Sec. 24, Symmes Twp. Clinton 3,189-3,223 ft. IP 148 M.c.f.d., IRP 570 psi. TD 3,254 ft. Gas discovery.

Wayne County:

Ohio Fuel Gas Co. 1 Henry Petersheim, Sec. 21, Salt Creek Twp. IPF 978 M.c.f.d., IRP 1,210 psi. Clinton 3,796-3,829. ft. TD 3,862 ft. New gas discovery.

OKLAHOMA

Alfalfa County:

Aladdin Petroleum Corp. 1 Pecha, C NW SW 9-23n-9w, 4 miles south of Goltry. IPF 1,501 M.c.f.d., with 24 BCPD, Meramec and Osage and Chester, 6,397 and 6,485 ft. SITP 1,480 psi., SICP 1,425 psi., 46 BO and 6 BSWPD from Chester, 40.5°. TD 6,640 ft. New oil and gas-condensate discovery, dual completion.

Beaver County:

Mid-America Minerals Inc. 1 Bartel, 1½ miles northwest of West Elmwood field in C NW SE 18-2n-23eCM. IPF 145 BO/16 hours, 14/64-in. choke, FTP 175, SITP 485/12 hours, 42°, upper Morrow 7,266-76 ft. TD 7,825 ft. New oil discovery.

Garfield County:

Sunray Mid-Continent Oil Co. 1 Baugh, C SW NW 14-20n-5w. 4 miles northeast of Northeast College Corner field. IPF 2,900 M.c.f.d. and 27 BCP 1,965 M.c.f.d., SIP 2,368 psi., Oswego 5,678-5,728 ft. TD 6,302 ft. New gas-condensate discovery.

Sunray 1 Fannie Hladik, C SW NW 32-20n6w, 6 miles northeast of Hennessey, IPP 17 BOPD, Manning Gor 550:1, 6,648-90 and open hole 6,875-7,072 ft. IPF 70 BO/8 hours from Meramec, 19/64-in. choke, FTP 200 psi., GOR 365:1. TD 7,072 ft. Dual completion, new oil discovery.

Jones & Pellow Oil Co. 1 Hedges, C NE SE 35-23n-6w, 1 mile northeast of Enid. IPP 35 BO and 70 BSWPD, Upper Miss. Chat, 39°, IPP 32 BOPD, basal Osage, 6,172-6,206 and 6,436-56 ft. TD 6,995 ft. Dual completion, new oil discovery.

Haskell County:

LeFlore County Gas & Electric Co. 1 O. Gross, 3½ miles northwest of West Milton pool in SE SE NW 2-8n-22e. IPF 250 M.c.f.d., 8⅝-in. casing, IPF 3,232 M.c.f.d., 2⅞-in. casing, IPF 10,-950 M.c.f.d., 2⅞-in. casing. Atoka, Spiro, Cromwell. Top of pay 3,040 ft., 5,772 and 6,136 ft. Open hole 3,040-3,350 ft., perfs. 5,772-84 and 6,136-61 ft. TD 6,290 ft. Triple zone gas discovery, new field.

EAST TEXAS

Anderson County:

Humble Oil & Refining Co. 1 M. C. Calhoun, John Little Sur., 8½ miles northeast of Palestine. IP 365 BOPD ¼-in., 38.4°, TP 1,100 psi., GOR 780 cu. ft.

per bbl., perf. 10,046-68 ft., Rodessa. TD 11,888 ft. Discovery well of Mound Prairie field.

Hopkins County:

Delta Drilling Co. 5 W. H. Coker, Nacogdoches University Land Sur., A-702 5 miles south of Como. IP 4,800 M.c.f.d., calculated open-flow potential, 142 BC per M.M.c.f., 58.7°, shut-in TP 3,758 psi., perf. 12,730-12,830 ft., Smackover. TD 12,947 ft. Deeper-pay (Smackover) in Como field.

NORTH TEXAS

Grayson County:

Leatherwood Drilling Co. 1 Escue unit, 1½ miles southeast of Perrin field in G. Henry Sur., A-2229, IPAOF 540 M.c.f.d., SITP 1,161 psi., Conglomerate 4,332-42 ft. Gas discovery.

Young County:

Texaco Inc. 1 F. V. Hinson, 5 miles northwest of Jean in Sec. 1471, TE&L Sur. IPP 87 BOPD, plus 26% water, 42.8°, GOR 742:1, Caddo 4,572-80 ft.; IPF 135 BOPD, 12/64-in. choke, TP 270 psi., CP packer, 43.5°, GOR 613:1, Miss. 4,972-5,010 ft. TD 5,400 ft. BBTD 5,136 ft. Dual oil discovery.

SOUTH TEXAS

Starr County:

Cortez. Appell Petroleum Corp. 1-C and 1-T Simon Trevino et al., 5 miles northwest of Sullivan City in Tr. 48, Porc. 94. IPAOF 2,530 M.c.f.d., TP 659 psi., BHSIP 703 psi., dry gas, 3,200-ft. Frio sand 3,205-8 ft. TD 3,601 ft. New gas discovery. IPAOF 4,600 M.c.f.d., TP 1,289 psi., BHSIP 1,387 psi., dry gas, 3,400-ft. Frio sand 3,438-42 ft. Dual gas.

South Jay Simmons. Mayfair Minerals Inc. and George H. Coates 1 H. A. DeGarza, Sh. 5, Santa Cruz Gt. IPAOF 4 M.M.c.f.d., TP 2,231 psi., 64.6, GLR 55,100:1, BHSIP 2,674 psi. 6,250-ft. Frio sand 6,267-71 ft. TD 6,500 ft.

Webb County, West Cole:

Morgan Minerals Corp. 2-H Rosa V. de Benavides, 4 miles north of Bruni in Sec. 412, GC&SF Sur. (Ygnacio Benavides, A-2529). IPF 17 BOPD, 8/64-in. choke, TP 875 psi., CP 1,150 psi., 43°, GOR 12,294:1, 3,574-77 ft. TD 11,504 ft. New oil discovery.

UTAH

San Juan County, North Lisbon:

Pure Oil Co. 1 USA-Big Indian, SE NE 33-29s-24e. IPF 7,400 M.c.f.d., plus 11 bbl. cond. per M.c.f. of gas, 29/64-in. choke, TP 1,710 psi., Mississippian 9,886-10,150 ft. TD 11,143 ft. Mississian discovery, new field.

WYOMING

Campbell County:

E. M. Davis 1 State, C SW NE 34-49n-69w. IPP 484 BOPD, Minnelusa discovery, new field. Minnelusa 8,420-38 ft. TD 8,637 ft.

Fremont County, Poison Creek unit:

Humble Oil & Refining Co. 1 Poison Creek unit, C NE NE 32-37n-93w. IPF 2,600 M.c.f.d., open flow, Fort Union 5,418-32 ft. TD 9,009 ft. Fort Union discovery, new field.

Fremont County, Frenchie Draw unit:

Humble 1 unit, C NE NE 21-37n-89w. IPF 4,220 M.c.f.d., 60 bbl. cond. 30 BWPD 9,101-83 ft.; 5,055 M.c.f.d., 57 bbl. condensate, 24 BWPD, 9,241-75 ft.; IPF 5,074 M.c.f.d., 60 bbl. condensate, 9,831-91 ft. TD 10,112 ft. Fort Union discovery, new field.

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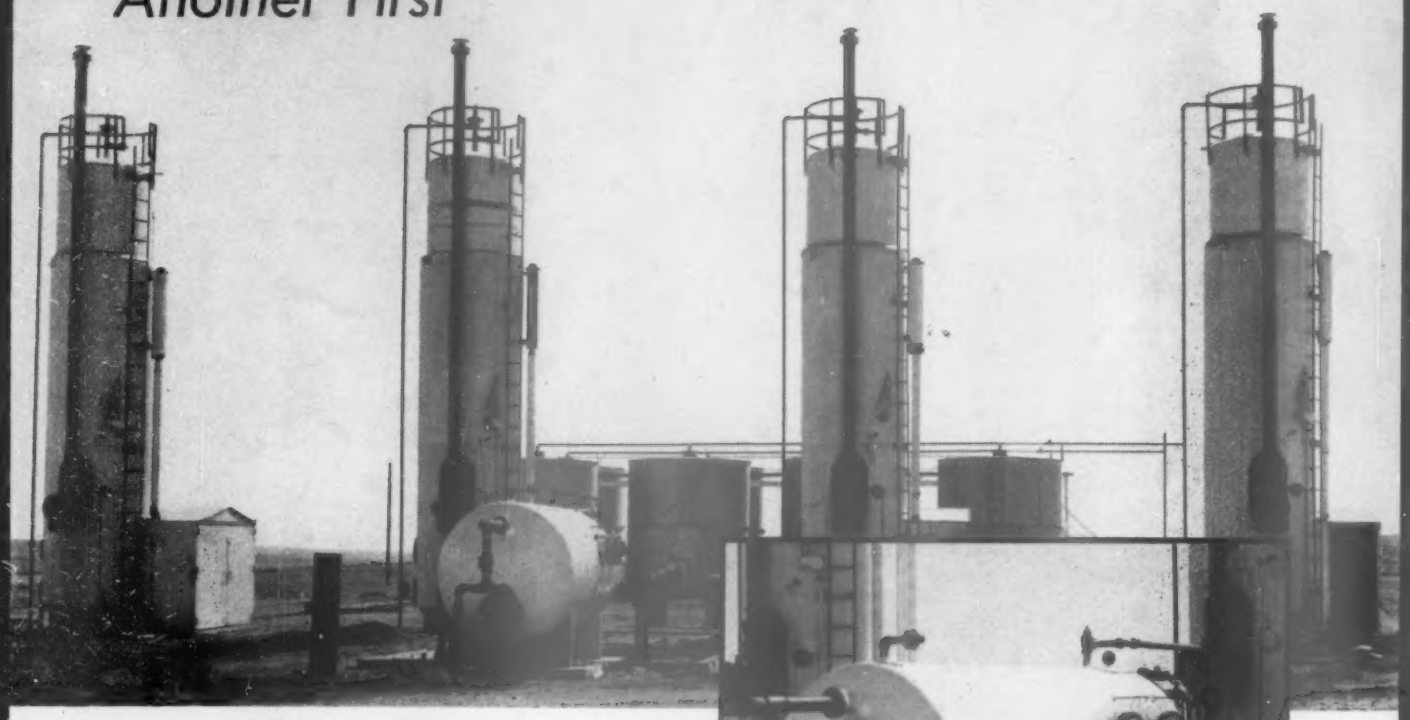

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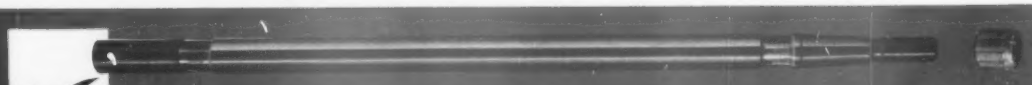

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